THE ENGINEERING RECORD

Published Weekly by the

McGraw Publishing Company

MAIN OFFICES:
114 Liberty Street, New York.
BRANCH OFFICES:
Philadelphia: 929 Chestnut Street.
Chicago: 1140 Monadnock Block.
Cleveland: Cuyahoga Building.
London Office: Hastings House, Norfolk St., Strand.

SUBSCRIPTION RATES:
United States, Canada, Cuba and Mexico....$3.00 a year.
Foreign subscription .... 6.00 a year.
25 shillings. 25 marks. 31 francs.
Foreign subscriptions may be sent to our London office.

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Change in advertisements intended for a particular issue should reach the office of The Engineering Record by 10 A. M. Monday of the week of issue. New advertisements can be received up to noon of Wednesday of the week of issue.

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Back Copies.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

Entered at the New York Post-Office as Second Class mail matter.

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Of this issue of THE ENGINEERING RECORD 12,000 copies are printed. Total circulation for 1905 to date, 504,500 copies.

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Uniform Municipal Accounts.

At the recent meeting of the American Society of Municipal Improvements a report was read by Mr. William Fortune, chairman of the Committee on Municipal Data and Statistics, which even the most enthusiastic advocate of standardization in public accounts could not consider encouraging. Although this gentleman has been advocating uniform methods of reporting such data for a number of years, and his ideas have been endorsed by the society, it is highly instructive to observe that not a single city has paid the slightest attention to them. His views have been strongly endorsed by a number of people who have investigated the subject, but the reform is still to come. It is not at all surprising just now, when investigating committees are bringing to light many accounts which eminent "magnates" probably consider insufficiently draped for exposure to the public eye, if uniform municipal accounting does not arouse popular enthusiasm. The methods of bookkeeping revealed by the insurance investigation in New York and the remarks of the scandalized judge in Missouri concerning the voting of Wabash proxies, have pretty thoroughly convinced people that the form of a financial report amounts to very little. The manner in which the figures are compiled is everything.

The Bureau of Statistics of the Department of Commerce and Labor has now spent some time in compiling on a uniform basis data of the leading items of expense in cities having populations of 25,000 and more. The lack of uniformity in the methods of keeping accounts in different cities has made this a difficult task. The blank forms prepared by the Bureau were often so unlike the books of the city that the public officials refused to fill them out and it became necessary to have the figures compiled by a special agent. Even in the case of these "personally-conducted" returns, it is not always safe to compare details too closely. The experience of the Bureau clearly confirms what this journal has repeatedly asserted—the hopelessness of attempting to compile uniform reports of undertakings that are extraordinarily diverse. For example, it is out of the question to compare the expenses of municipal engineering in Boston, New York, Philadelphia, Pittsburg, Chicago and St. Louis without an amount of work that is not warranted by the value of the information when it is obtained. The reason is because the systems of government in the cities differ so greatly. To introduce many of the proposed forms of uniform accounts in some of these cities would entail a lot of work for the benefit of a very few people. If the cost of any particular service in any city is desired it can be ascertained without much trouble, even if it is rendered by the co-operation of several departments. This is a different matter, however, from the compilation of all the expense accounts of a city on a system which has no relation to the way in which the expenses are incurred.

These comments do not signify that The Engineering Record is not a believer in uniform reports for municipal data. It strongly wishes such reports were made throughout the country, and it believes that the uniformity in water works reports which is slowly developing as the result of persistent endeavor by the New England Water Works Association is one of the best public achievements to the credit of American technical societies. But this conviction is accompanied by one equally firm, that to urge uniform reports without more uniform systems of government is to attempt to drive with the cart before the horse. It is not surprising that most cities prefer their own ways of carrying on the public affairs, and resent any attempt to change them. They are not to be blamed for opposing an attempt to saddle a place of ten thousand population with a form of government suitable for a city ten times as large merely for the purpose of uniform accounting.

There is another and very important view of the subject, however. The city is a creature of the State, subject to the laws of its Legislature and given an organization fitted to handle local affairs not sufficiently important to be decided by the Legislature. The State has to exercise a certain degree of supervision over it, and this supervision is better and more economically conducted if all cities of about the same size have about the same organization. This is now the case in Ohio, where there is a State auditing department for municipal affairs. This is a comparatively new venture, which caused considerable friction when it was first introduced, but is now working smoothly. There is too much interference by the department with municipal expenditures, and this should be reduced. Otherwise, however, it is by all means the most promising step to secure uniform municipal reports that has yet been taken.

Progress in Sewage Disposal.

There have been few announcements lately more interesting to the municipal engineer than the statement that septic tanks and sprinkling filters would be used to purify the sewage of Columbus. It is noteworthy that this important decision, establishing in engineering favor a method of disposal hitherto regarded with considerable suspicion in America, comes from the same section which also furnished the comprehensive experiments that proved first to many engineers the efficacy of mechanical filters for the water supply of large cities. Just as Louisville adopted mechanical filters because the raw water was not suited for treatment by slow sand filtration, so Columbus has been forced to break away from intermittent filters for sewage because the local conditions would render them very expensive and their results little if any better than those of the system adopted. In each case the innovation was not adopted until a prolonged experimental investigation demonstrated beyond question that it was certainly the best plan for the conditions. And in each case the results have shown that such investigations, conducted with scientific care and for a sufficient period to furnish ample data for an accurate judgment to be formed, are worth many times their cost.

The sprinkling filter is a decided novelty in this country, although in Great Britain, where it is known as the percolating filter, it has been employed for a good many years. It is an improvement on the contact bed for some purposes, although just how wide its applicability may be is not definitely known. Its fundamental merit is its high rate of operation, which enables works of large capacity to be constructed on a limited area, as compared with the much greater areas needed for intermittent filtration. Another and hardly less important merit is the fact that the beds are composed of coarse stone readily found in most localities, while really good sand for intermittent filtration is not easily obtained in many parts of the country. The nearest supply for Columbus, for example, was found to be located on the shore of Lake Erie.

Along with the advantages of low cost which sprinkling filters possess is the disadvantage that they perform only one part of the process of sewage purification. Their work is done by aerobic bacteria, and their greatest success is only achieved when the sewage is prepared for them by breaking up and dissolving all the organic solid matter in fresh sewage. This process of breaking down and dissolving, called in a rather uncertain way hydrolysis, is brought about by anaerobic bacteria working in sewage held practically quiescent in basins or tanks. In some places these tanks are decidedly offensive and in others they are not, and it is not at all improbable that when they are employed on the large scale, without covers, proposed at Columbus they will be found to require far more attention than the comparatively novel filters which receive their effluent. The experimental investigations carried on at Columbus leave no opportunity for doubt concerning the successful operation of these works, financially and technically, but it goes without saying that the details of management of such a large plant will present many novel problems. These will be solved satisfactorily and speedily, it is certain, and Columbus will then enjoy the distinction of having one of the finest and most economical sewage disposal systems in the country. Moreover, it will be a plant possessing many points of superiority over similar British works, for it will embody all their features demonstrated by successful operation to be good and avoid several of their poor features, such as the use of unsound filling for the beds.

Street Improvements in Old Cities.

If our older cities, those fully developed prior to the Civil War, were to be built now they would undoubtedly be laid out better, although it is possible that in making some improvements we would also make some serious mistakes. It is no easy matter either to lay out a new city or to remedy the plan of an old one, particularly as new methods of rapid transit within the city limits are introducing certain transportation problems of still unknown importance. Many marked improvements have been made in some of the oldest cities by the creation of new streets, by reclaiming water-front property, as in the Back Bay in Boston and the Thames Embankment in London, and by improving old streets. There is no finer street than the Avenue de l'Opera in Paris, a creation of the Haussmann regime, while in London there is High Holborn to prove the value of such betterments. In New York, the opening and elevation of Duane Street has made "Five Points" a filthy memory, buried fully ten feet deep below the cleaner level of commercial interests built on and about its ruins.

What may be termed the sanitary and moral betterment due to such change is not by any means the least advantage to be gained, and in some cases the changes would be entirely justified if this betterment alone were considered. What was accomplished in the slums of Paris needs to be done in some of the older American cities, which are themselves new as compared with the French capital. If the districts southwest and northeast of the junction of Chestnut and Eighth Streets in Philadelphia, and east of the Bowery in New York, now among the most densely peopled urban sections in the world, had wide boulevards cut through them, the atmosphere would be physically and morally improved and much needed lines of rapid transit established. The merits of diagonal streets are so great that they ought to be cut through some of the older cities as soon as it is definitely certain what routes are best for them. These will depend on local circumstances. In New York there are certain focal transportation points fixed by bridges and ferries, and if new avenues are built to open up the crowded parts of the metropolis they should be laid out to conform with transportation needs rather than along lines determined by drawing diagonals to the present block plan of streets. The diagonal streets will leave some plots of land of poor shape for business purposes, however they may be drawn, and, accordingly, it is better to lay them out to meet real needs than to conform with existing rectangular systems.

The opinions concerning the width of streets have changed as much as those regarding their proper planning. Narrow streets were sufficient when trucks and carriages were not numerous. With the increase of street traffic of all kinds, the advent of wide and swift-running street cars, and the marked increase in the height of buildings, streets must be wider. A 60-ft. street is narrow enough for the quietest neighborhood in a large city, although its roadway need not be paved for a greater width than 20 or 25 ft., while 80 and 100 ft. are not excessive widths for main thoroughfares. Avenues wider than 100 ft. are generally undesirable except for park purposes, where trees and grass are to grow in the middle. It is interesting to observe, also, that it is often necessary to make wider streets for commercial traffic than in the most wealthy residential sections. Lower Broadway is too narrow and Fulton Street is not nearly wide enough in New York, to state two well-known examples of overcrowded streets. On the other hand, it must be considered in cutting new streets through cities that the value of the property condemned for the purpose will be very great, and on this account the thoroughfare should be no wider than is really necessary. Recent progress in engineering has indicated one method of meeting the conditions which was not practicable when Napoleon had his engineers cut their way through parts of Paris. This is the subway, and it is interesting to observe that, in the recent report of the Royal Commission on the improvement of transportation facilities in London, the great avenues suggested for future construction have such subways. It goes without saying that if a street can be constructed on a double-story system, with the street cars down in its cellar where they will not interfere with other traffic, the width of the streets can be materially decreased and the land damages correspondingly reduced.

At first glance the destruction of property, the removal of the street areas from assessment, and the cost of reconstruction would seem to prohibit most improvements of this nature. The betterment is, however, almost always remunerative to the property owners and to the cities, while the benefits to the community at large are themselves worth all the cost of the work. Whenever it is proposed to open such avenues of health, convenience and beauty in our older and richer cities, nothing but the most potent arguments should defeat the project. City conditions are sordid and disagreeable enough at the best, and those who propose to improve them by letting more light into the dark places, improving the transportation facilities and adding to the beauty of the city deserve all reasonable support, for their missionary work will be slow and tedious even in the most progressive community.

Railway Rates.

The announcement that the most important part of President Roosevelt's message to Congress will relate to the regulation of railway rates will cause anxiety to many readers of this journal. It seems as though the railroads should be given some breathing time to recover from the assaults on them in the last session of Congress, before attacking them again. They are not a mortal enemy to the progress of the country. The President himself said in his message of Dec. 3, 1901: "It must not be forgotten that our railways are the arteries through which the commercial life-blood of this nation flows. Nothing could be more foolish than the enactment of legislation which would unnecessarily interfere with the development and operation of these commercial agencies." Yet it is proposed to cripple the greatest single industry in the country, the largest employer of labor, and the most important instrument of commerce of all branches, in order to gratify the spite of a few manufacturers who do not believe in letting railways charge what the traffic will bear.

It is commonly claimed that by taking the rate-making power from the railway officials and giving it to the Interstate Commerce Commission, the desire of the people would be carried out. The Engineering Record fails to find any such expression of opinion outside the reports of the Commission and a few manufacturers whose works are not located in proper places and expect the railways to make good the results of such an adverse condition. It is not true that there is any public demand to give the rate-making power to the Interstate Commerce Commission; the public is entirely satisfied that the common good is sufficiently safeguarded by the laws which, if enforced, will make unjust rates illegal. What the public desires, particularly that portion which has invested its savings in the shares of commercial and manufacturing companies as well as railways, is intelligent and honest administration of the laws and not the making of rates by the Interstate Commerce Commission.

There was a time, it is true, when people considered that railway rates were too great and their close regulation was a public duty. This opinion has been given up as the facts of the rate problem became known. Ever since the eminent president of Yale University, Dr. A. T. Hadley, began his writing in favor of allowing the railroads to charge what the traffic will bear, the old hostile feeling has been disappearing. People know now that any system of rates by which each article pays its share of the fixed charges would virtually prohibit the movement of coal, grain and many other commodities. Prof. W. D. Taylor, of the University of Wisconsin, recently summarized the whole problem by stating that rates must move the freight, and, if possible, must move it in increasing quantities. This means, as Mr. W. M. Acworth has pointed out in his "Elements of Railway Economics," that the total railway revenue is made up of rates which, in the case of traffic unable to bear a high rate, are so low as to cover barely more than actual out-of-pocket expenses; which, in the case of medium-class traffic, cover both out-of-pocket expenses and a proportionate part of the unapportioned cost; and which finally, in the case of high-class traffic, after covering that traffic's own out-of-pocket expenses, leave a large and disproportionate surplus available as a contribution towards the unapportioned expenses of the low-class traffic, which such traffic itself could not afford to bear.

This explanation of the nature of rates shows why the present attempt of the Interstate Commerce Commission to seize the rate-making power is so fraught with danger to the welfare of many of the readers of this journal. With the best of intentions and highest intelligence, the Commission would be entirely unable to act as justly to all concerned as can the railway managers, with their representatives in every city and town in the country. When the ice crop failed in the Hudson River the railroads saved New York from an ice shortage by making a low rate to enable supplies to be shipped from distant points. The last time a shortage of the Kansas corn crop threatened the stockfeeders of the region, emergency rates were at once put in force to enable corn to be shipped from more fortunate States at a cost that would not bankrupt the Kansas people. Many times a western railway has saved mining undertakings by giving low rates during certain periods of depression, while the rates on brick, stone, cement and other building materials are continually fluctuating. In short, a great secret of success in railway management is the adjustment of rates so that there will be healthy commercial and industrial growth, which implies a knowledge of what shippers need in each hamlet and city in the country and the power to meet their needs.

At present the railways serve this purpose well. Take from them the rate-making power and their ability to meet local needs is paralyzed. The Interstate Commerce Commission, keeping no agents throughout the whole country, will be at the mercy of the eloquence of the best talkers and the attacks of the hardest kickers. Depending on theory and not actual knowledge of shippers' needs, how can it make just rates? Only once in the country's history has the government interfered with a great industry, and those who reflect upon the wrecked enterprises, commercial stagnation and misery that followed Jackson's toying with the banking business cannot view without grave apprehension the attempt of the government to run the railroads through a commission of a few men who have to assume no financial responsibility for their acts.

Engine Improvements.

About nine years ago mention was made in these pages of certain tendencies in modern machine design which were resulting in a higher efficiency of the essential working parts and less elaborate finish. The improvements of the first class were largely called for by the peculiar conditions of electric central stations, where the maximum capacity of the equipment might be suddenly required and the fluctuations of load were far greater than in ordinary mill and factory service. Under these demands an increase was made not only in the strength of the engine frames and beds but also in the sizes of the principal working parts. The diameter of the shaft for a given size of cylinder has been enlarged, and with it the length of the main bearings. The diameter and length of crank pins and crosshead pins and the bearing surface of the crossheads were all increased to meet the demand for excessive loads. This improvement was extended from electric lighting engines to mill work and other power equipments, but only at first in the products of the best builders. These changes have been taking place steadily in the designs of other builders since they were first mentioned in this journal, until at the present time it is safe to say that the proportions of the engines built in all reputable shops are ample and well balanced. Of course there are marked differences in the ratings given by different builders to practically the same design, and some makers have developed special details of greater or less value, but taking the steam engine as a whole it is hard to see where it is open to any marked improvement until some new class of service imposes requirements as novel as those which arose in the early electric central stations.

There can be no question about the good results that have followed curtailing the exterior finish of engines. It was formerly considered that high finish in details was an important criterion as to the general excellence of a machine. Those who have to keep an engine in continuous operation and in repair have learned that the labor employed in perfecting such details is well-nigh thrown away, for after the novelty of the new machines has once passed the matter of finish is forgotten. Besides, the finished parts are sometimes not maintained in perfect condition, and it is not long before the finish deteriorates, so that the appearance of the parts is far less acceptable than it would be if the finish had originally been absent and the parts simply painted.

In this connection mention may be made of three cross-compound electric railway engines which were directly connected to generators. These engines had been in operation several months, when examined, working with steam having a pressure of 140 lb. per square inch, at a speed of 90 revolutions per minute, and running continuously twenty hours a day. They were operating without jar or knock in the main connections and there was no heating in the bearings or other objectionable features in their running qualities. The same statement could be made in regard to their entire period of service from the very beginning, although the conditions of boiler pressure, speed and duration of daily run were such as to subject the engines to severe usage. An examination of the finished work on these engines was not productive of particularly satisfactory results, however, for the bright parts on the valve bonnets, cylinder heads, shafts and connecting rods did not show that fine-grained, polished condition which is ordinarily considered an evidence of superior workmanship. The corners of the finished parts, which for the better class of work should be sharp and regular, with no blemishes, were likewise defective if examined with that critical eye which is looking for perfection of form and finish. In spite of these imperfections, which were confined to matters of finish solely, the engines ran well and carried their heavy loads without a murmur from the day they were set to work. The money that would have been spent in perfecting the finish on these engines would have been thrown away, in the opinion of this journal, for in most cases the only parts it pays to treat in this way are those which can be maintained in perfect form and condition without unnecessary labor on the part of the attendants.

The labor of constructing a steam engine should be applied where it will do the most good; that is, on the working parts of the machine. The vital parts of an engine are the beds and frames, the main bearings, the crank pin, crosshead pin and guides, the pistons and the cylinders. If these are strong and well-made, the desired end is accomplished and all labor of construction is effectually utilized. Modern steam engineering is making noteworthy progress along these lines.

Notes and Comments.

Ground Subsidence due to salt-mining has been so serious at Northwich, England, that the public library, built twenty years ago at the expense of Sir John Brunner, has been condemned and will be torn down.

Acetylene Lighting continues to develop steadily in spite of former predictions to the contrary. Statistics gathered by the German Acetylene Association show that there were 75 places in Germany, 202 in the United States, 16 in the United Kingdom, and 19 in the British colonies provided with public lighting supplies, and in Germany alone there were 25,000 smaller installations. An interesting feature of the development of this system of lighting is the difference in its directions in various countries. Incandescent mantles for acetylene are practically unknown in the United States, although extensively employed in Germany, and the practice in purifying the gas varies widely.

Double Superheating in a 60-h.-p. portable boiler and engine set has been investigated carefully by Prof. Josse. The steam is superheated before entering the high-pressure cylinder and again before entering the low-pressure cylinder. Indicator cards were taken every ten minutes and readings every sixteen minutes. The results were found to compare very favorably with those of the 4,500-h.-p. Sulzer engines in the Berlin Moabit station. At 219 r.p.m., 178 lb. boiler pressure and 55.1 b.-h.-p. the steam consumption was 9.55 lb. per indicated horse-power. Prof Josse states that not only was the temperature of the cylinder walls maintained by the superheat, but the superheated steam was found to give up heat less easily than does saturated steam, and the heat interchange with the walls was accordingly diminished, in spite of the greater temperature difference. The arrangement of the parts of this power set is unusual. The high-pressure cylinder with its valve chest is placed in the upper or coolest part of the smoke box, in which the two superheaters are also placed, that for the high-pressure supply being nearer the fire tubes. The low-pressure cylinder is mounted on the boiler and is jacketed by the high-pressure steam from it. The boiler tests showed an efficiency of 77.7 per cent. The gases had a temperature of about 370° C. when leaving the fire tubes, and only 191° in the stack.

The Utility of a Road Roller for unusual purposes is shown by some recent occurrences. A small cold-storage plant on Cape Cod had an accident which put both boilers out of commission. In order not to shut down entirely, a couple of road rollers were brought from some state highway work a few miles away and furnished steam until other boilers could be set up. In another case in a New Jersey city, an electric railway persisted in building a bridge without legal authority to do so. Accordingly the city authorities attached their heaviest roller to the girders of the structure with strong chains and pulled them down. When this work was finished, the abutments were destroyed.

The Use of Gas in Great Britain continues to develop, although there was a time when the competition of electricity, particularly where the central stations were owned by municipalities, was expected to make gas an unimportant factor in city life. This expectation has proved unwarranted, as might be expected, for no great change has ever yet come about so rapidly that a single generation witnessed the practical annihilation of great investments of capital. Many readers will doubtless recall the panic in telegraph shares which occurred when the practicability of the telephone was established, yet the telephone has not replaced the telegraph to any marked extent. Similarly electricity has not affected the gas industry materially, and in some cases where it replaced gas for a time the latter has again been adopted. For example, gas lighting has replaced electric lights on a number of London streets, on the Waterloo Bridge, and in the Victoria station. In Great Britain, as a whole, the number of consumers and the amount of gas made show a steady increase, although the introduction of incandescent burners, suction producers and large plants for manufacturing and distributing fuel gas have all worked to cut down the consumption of illuminating gas.

A Plumbing Regulation which recalls the early fights of The Engineering Record for sound principles of sanitation, is now under consideration by the Chicago city officials. Chief Sanitary Inspector Hedrick of the Department of Health secured the passage of an ordinance which prescribes a test of 10 ft. of water on all drains within the walls of buildings, which are now made of tile in many cases. The test would practically prohibit this use of tile, and the makers of it are accordingly protesting strongly against the enforcement of the regulation. Almost a quarter of a century ago this journal fought this matter to a satisfactory conclusion in New York, for the first time in America, and secured the passage of a plumbing code requiring cast-iron pipe to be used exclusively for drains within a building. Experience has completely justified that regulation. Only cast-iron pipe can be made tight enough for such service and strong enough to resist breakage should the foundations settle, as they often do. The lead joints will allow a certain amount of motion which the cement joints of a tile drain will not permit. The difference in cost of the two materials is too trivial to be considered, even for the least expensive cottage, and the Chicago regulation ought to be enforced.

Site of the Roosevelt Dam and Canyon below It.

THE SALT RIVER PROJECT, U. S. RECLAMATION SERVICE.

One of the most important structures yet undertaken by the U. S. Reclamation Service is the great dam on Salt River, which will be about 270 ft. high, contain over 300,000 cu. yd. of masonry, and impound 1,300,000 acre-feet of water, or over four billion gallons.

The history of Salt River is typical of the majority of Western valleys where irrigation has developed. Irrigation began over thirty years ago by the diversion of the waters of the river in small ditches upon the lower lands. Other ditches were taken out higher and parallel with the first, and finally large canals on both sides of the river were built commanding a total of over 200,000 acres of irrigable land, while the low water discharge of the river is hardly sufficient for one-eighth that area.

Great development was induced by a series of wet seasons ten to fifteen years ago, and many large orchards were planted and brought into bearing only to perish by the drouths of more recent years. The depopulation of the valley was in a great degree threatened when the storage project was brought to the attention of the Reclamation Service. This, then, is a case not only of making new homes, but of saving those already made. The land owners have given liens on the lands benefited to secure the return to the Reclamation Fund of the cost of the project, as required by law.

The existing canal systems will be utilized for distributing the water, but require new diversion dams and headworks. The main structure, however, is the storage dam above mentioned, for storing the flood waters and holding them until required for use. The greatest difficulty met in the construction of the dam is its inaccessibility. It is surrounded by a wide belt of mountain country scored by deep canyons, and over $100,000 have been expended in wagon roads to bring it into touch with the outside world.

The railroad haul from the most available cement plant is over a thousand miles, with mountain grades, and the long rough wagon haul to the dam made the price of Portland cement at the dam site on the basis of current rates about nine dollars per barrel. Under these conditions search was made for materials which could be used for the manufacture of cement. Several samples were analyzed and trial burns were made, which demonstrated that suitable material existed in abundance near the dam site for making a true Portland cement of superior quality. Accordingly a cement mill was designed and erected, capable of producing over 300 barrels per day. The fuel used for burning the cement is crude oil from California. Freight on this oil is also an important item, but as one pound of oil will burn about five pounds of cement, the manufacture may be regarded as an 80 per cent. solution of the freight difficulty.

Another problem was that of furnishing power for running the mill, and for constructing the dam. Some mesquite and cottonwood grows in the reservoir site, but this is limited in quantity and inferior in quality, and entirely inadequate to solve the power problem. Freight charges make coal prohibitive and oil very high. It was finally decided to develop water power, as this, though expensive, can be used afterwards for pumping purposes, and the power canal will be necessary also for sluicing sediment from the reservoir in future. A unit of 900 kw. has been installed, and will soon be followed by another, both taking water from the power canal. It is expected also to draw water from the reservoir after completion through wheels under the full head of the water in the reservoir which will, however, be variable.

By the use of this power it is expected to add to the water supply by pumping from underground, to an extent sufficient to add to the irrigated area about 30,000 to 40,000 acres. The total area to be served will be somewhat over 200,000 acres, including that now under cultivation. The water will flow from the reservoir down the river to a point of diversion just below the mouth of the Verde River, where the largest canal of the valley heads.

At short and irregular periods the flow of the Verde River will be sufficient to supply all the needs of the canal system. At these times it is expected that the Salt River reservoir will be entirely closed and the water flowing therein saved for such time as it will be needed. The supply of power will, of course, be cut off when the supply of water ceases, but as this power is used entirely for pumping, the requirements and the availability will be coincident. Whenever the Verde ceases to furnish enough water this will be supplied partly by water drawn from the Salt River reservoir, which will be used to develop power to pump from the valley and the shortage thus provided for.

The dam was designed by Mr. Louis C. Hill under the direction of a consulting board of engineers consisting of Messrs. George Y. Wisner, W. H. Sanders, and A. P. Davis. It is to be of gravity section and will also be constructed on a curved plan with a radius of 400 ft. The canyon walls being very steep and much higher than the dam, it will be necessary to cut spillways around the ends of the dam in the solid rock. This rock is hard, compact, red sandstone, and it will be used in the construction of the dam. The quantities in the dam and spillway are approximately balanced. Water used for power purposes will be drawn through the power canal and through pipes placed in the dam. Any additional water required will be supplied through a tunnel at the river bed through the rock abutment, and it will also be used for sluicing sediment out of the reservoir. This tunnel will be closed by two sets of three gates each, 4 ft. by 10 ft. in dimensions, operating under a possible head of 230 ft. The gates are of cast steel with bronze bearings and operate on rollers similar to the Stoney type. They were designed by Mr. Teichman under the direction of the consulting board. It is provided that a roadway shall cross the dam and this will be carried across the spillways by means of reinforced concrete bridges.

The specifications provide that work on the dam shall be carried on night and day and that in the upper portion the engineer may prohibit work during the three summer months. These provisions will insure the placing of masonry in relatively low temperatures so that the temperature strains will be rather of compression than of tension.

The contract for the dam has been let to James M. O'Rourke & Co., Galveston, Tex. The entire Salt River project is under charge of Mr. Louis C. Hill, and the power developments are designed by Mr. O. H. Ensign, electrical engineer. The manufacture of cement is in the charge of Mr. S. Duryee, who also designed and erected the mill. Its operation has been very successful and a remarkably high grade of cement is being delivered.

Floods exceeding 4,000 second-feet are liable to go over the dam. The river, at low stage, is diverted through the tunnel or a temporary flume by means of a temporary diversion dam. A row of sheet piling across the canyon below the dam site prevents the return of water by seepage. As soon as practicable a tight wooden flume, not less than 50 ft. wide and 5 ft. deep, has to be provided by the contractors, leading from a level 5 ft. below the top of the diversion dam and discharging below outlet of tunnel.

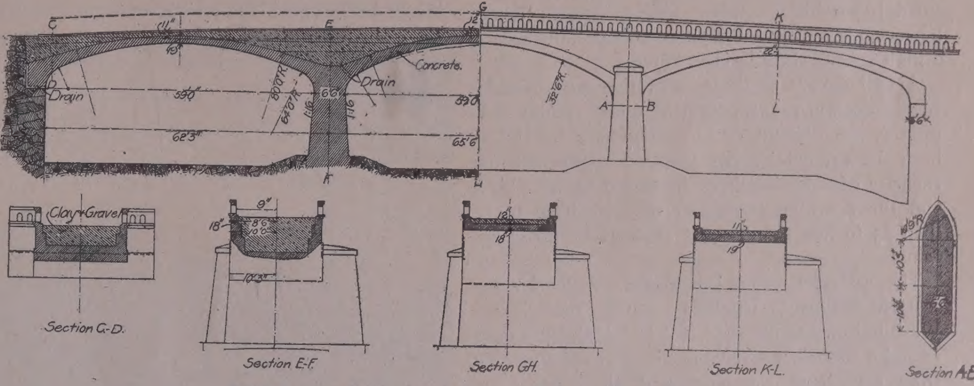
The foundation is thoroughly cleaned of all gravel, sand, and earth, and all fissured or disintegrated rock is removed so that the dam shall be founded on solid rock throughout. Explosives are not used in excavating the rock in the foundation unless absolutely necessary; and when used, in small quantities only. A trench is being cut in the solid rock of the foundation 15 ft. from the heel of the dam, 10 ft. wide and 6 ft. deep below the general bottom of the dam.

The main body of the dam will be of broken range cyclopean rubble, laid so as to break joints and thoroughly bond the work in all directions. The stone will be quarried from the walls on each side of the canyon along the spillways as before mentioned. If a sufficient quantity of hard fine-grained stone cannot be obtained in these spillways the additional supply will be quarried from the bluffs at either end of the dam. Each stone will be thoroughly drenched and cleaned of dirt and laid in Portland cement mortar. Vertical joints between the stones inside of the face stone of the dam must be nowhere less than 6 in., and must be thoroughly filled with Portland cement concrete or mortar, rammed into place by hand. Spalls may be rammed into the mortar in the vertical joints and rock may be rammed into the concrete where the joints are large enough. Pieces of rock must not be nearer to another than 2 in. All overhanging edges must be hammered off, and concave or otherwise improper beds are prohibited. The aim is to use the largest proportion of stone and the smallest proportion of mortar and concrete in the dam that can be practically secured. To this end facilities will be provided for handling stone weighing 10 tons, and large stones will be used as far as practicable. All masonry is kept wet during the time of construction and until the work is at least six days old.

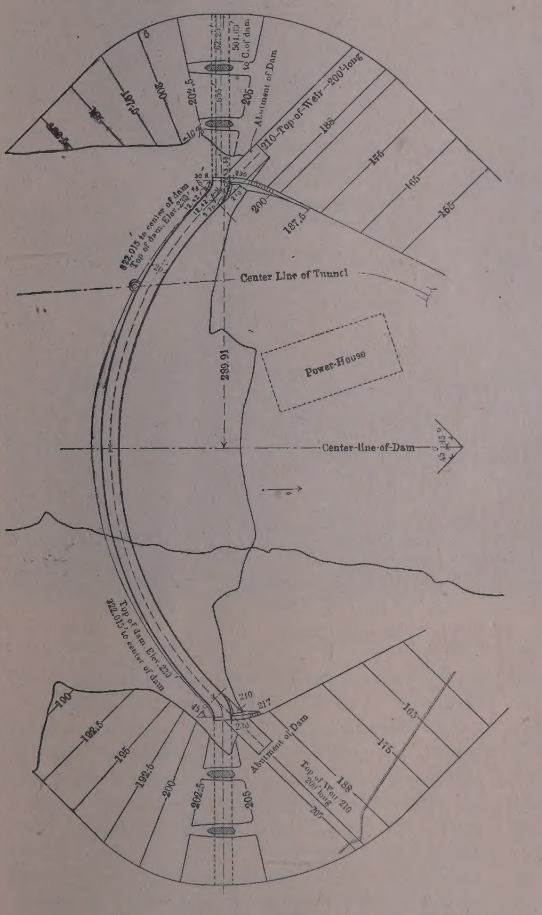
The stone for the up-stream face are selected so as to lie with horizontal beds and vertical joints in 1:2 Portland cement mortar. No mortar joint in the face may exceed 2 in. in thickness. At least one-third of the area in the face must be headers evenly distributed throughout the wall, and every header shall be laid over a stretcher of the underlying course. The stone must be so arranged as to break joint in no case less than 1 ft. with the stone of the underlying course. The stretchers must be not less than 3 ft. long nor less than 2 ft. in any other dimension; the headers must not be less than 6 ft. in length nor less than 2 ft. in any other dimension. The joints in this face of the dam will be dug out to a depth of at least 3 in. and be carefully pointed. The face wall will be kept at all times at least one course higher than the body of the dam opposite.

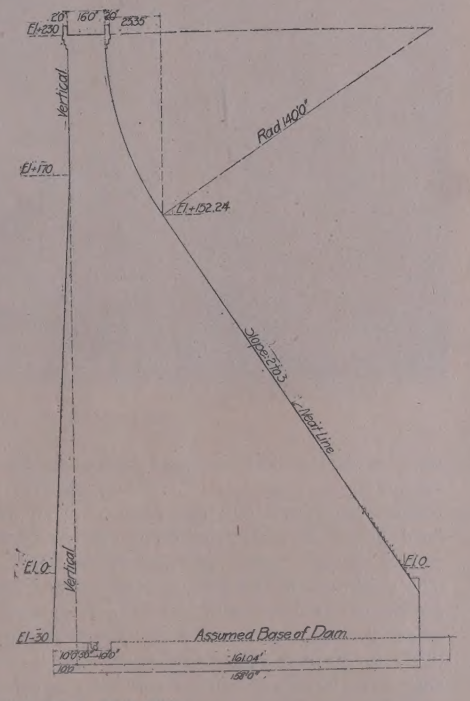
The stone for the downstream face will be so selected as to lie with horizontal beds and vertical joints, and each stone shall be laid in a bed of mortar composed, where not otherwise directed, in the proportions of 1 part of cement to 2½ parts of sand. At least one-fourth of the area in the face must be headers evenly distributed throughout the wall, and every header will be laid over a stretcher of the underlying course. The stone will be laid in steps.

In preparing concrete the run of the crusher will be taken, the parts passing a ¼-in. screen being classed as sand. The sand will be free from organic matter, and contain not more than 10 per cent. of clay or other foreign mineral substance. Where not otherwise directed, the proportions of separate aggregates will be 1 part of cement, 2½ parts sand, and 4 parts of broken stone of such size as to pass through a 2-in. mesh screen.



Bridge over Spillway of Roosevelt Dam, Salt River.





Plan and Section of Roosevelt Dam, Salt River.

A Broken Rail, not discovered by a track walker, has been held by the Maryland Court of Appeals to indicate negligence as respects a passenger on a car subsequently derailed at the break, regardless of the condition of the track prior to the break. The accident referred to, 61 Atl. Rep. 618, occurred on a 5-deg. curve on a grade of 70 to 80 ft. The rail had been down 20 years, and had lost 4 per cent. in weight.

Electric Traction for Railroad Service.

A paper read before the Canadian Railway Club by J. A. Shaw, Assistant Electrical Engineer, Canadian Pacific Ry.

It is to-day generally admitted that, so far as the actual moving of trains is concerned, the electric motor can do the work better than the steam locomotive. But the more important question is, will it pay to convert steam roads to electric. This is best answered by the amount of such work which is now being carried out throughout the world, the results obtained and the advantages possessed by electric traction. These may be briefly enumerated as follows: (1) Those appealing to the passenger, and the consequent increase in traffic. (2) Those relating to the operating of trains from one central power house. (3) The savings in capital, maintenance and operation. The most noticeable advantages to the passenger, namely those affecting his comfort, are the cleanliness of the cars due to the absence of smoke and cinders, especially in tunnels, also the better distribution of heating and lighting made possible. Another factor is the higher speed attainable, not only for continuous runs, but with the same running speed as on a steam line, the average speed is higher and the duration of the trip reduced by the more rapid starting and stopping made possible by the increased traction due to the unifrom rotary movement of motors. An additional gain in runs of considerable length would be in the abolition of stops for water or fuel.

The saving in the cost of generating power in a large central power house, with the refinements possible in steam generation and consumption as well as to the high load factor, is apparent, especially as the cost of fuel increases at the more remote fuel stations on a steam road. An inferior grade of coal may also be used, or if water power is available the cost of power will be very largely reduced. In spite of these advantages, it is questionable if a saving could be shown for electric traction in its present stage, on a road with infrequent trains. Under present economical conditions electricity is limited, to a certain degree, to large terminals, suburban lines, spurs to main lines, and mountain railways. However, the operation of through trunk lines will come shortly as the art advances and as the various water powers throughout the country are developed.

The cost of roadbed construction is in favor of electric traction, a higher grade being attainable and permitting of a shorter route. The equipment of an electric road is higher than the initial outlay for equipping the same road for steam operation; this difference is, however, counterbalanced by the larger outlay for terminal facilities and the cost of steam and water stations for a steam road.

Experience has shown that maintenance and operating expenses with electric traction are much lower than with steam. This applies especially as regards track up-keep, the roadway being subjected to less wear and tear as there is no jumping, pitching or side-way oscillation. A road with heavy traffic and a large and efficiently operated power house should use only one-half as much coal as one using steam locomotives, and this may even be reduced to one-third by the application of refinements made possible with large steam generating plants. This saving, it is stated, has been made by the Italian Mediterranean Ry. On another converted road it has been observed that the cost of lubrication is now less with electric traction, and the absence of smoke results in an important reduction in the cost of cleaning. The wages of train staffs on an electrically operated road can be materially reduced as the engineer and fireman are replaced by a motorman who does not need to go through a long and complicated training and who consequently is not entitled to so high a rate. This saving in labor, however, is questionable practice, especially where a high speed schedule is in force

Actual figures of the comparative cost of electric and steam roads, operating under similar conditions, are difficult of obtaining as yet. It has been determined by city elevated roads that the capacity of lines has been increased by one-third, and the operating expenses reduced from more than 55 to less than 45 per cent. of its gross receipts.

The assistant general manager of the North-eastern Railway, England, stated recently in Washington that his road had in self-defense converted a suburban service in order to regain traffic from competing tramways and to increase its amount. This they had successfully accomplished with a large increase in traffic, with a resulting reduction in expenses, so that the net revenue now more than covers the interest on the extra cost of installation of new system.

The experience of another English railway, namely, the Lancashire & Yorkshire, has been somewhat similar. This railway adopted electric traction not primarily for the sake of economy, but to increase receipts and decrease the crowding of terminals. During the twelve months the line has been operated electrically there has been increase in traffic, but the cost of operation has been more expensive. The cost of coal per ton-mile is greater, but the running expense less because of the greater mileage run by train crews. The introduction of electricity has increased the capacity of terminals 30 to 40 per cent., due to the elimination of the time lost in handling a train upon its arrival, the electric motor cars only requiring motormen to carry the operating lever from one end of train to the other, and the throwing of one or two switches is the only operation required for fitting the train for a run in the opposite direction.

Total combined operating expenses show a considerable reduction can be made in the cost of conducting transportation by the introduction of electric traction, but it is difficult to secure figures that will permit an exact analysis of each of the items which go to make up the saving.

At present there are, generally speaking, five systems available for heavy electric traction:

(1) The direct-current system, such as now exists on our street and interurban lines.

(2) The alternating-direct-current system, consisting of sub-stations placed at intervals along the line to which alternating-current power is transmitted at a high voltage and then lowered by step-down transformers to synchronous motors driving direct-current generators feeding the trolley.

(3) The single-phase, alternating-current system, in which single-phase motors receive power from transformer sub-stations along the line which receive either high-voltage single-phase or polyphase alternating current from the power station.

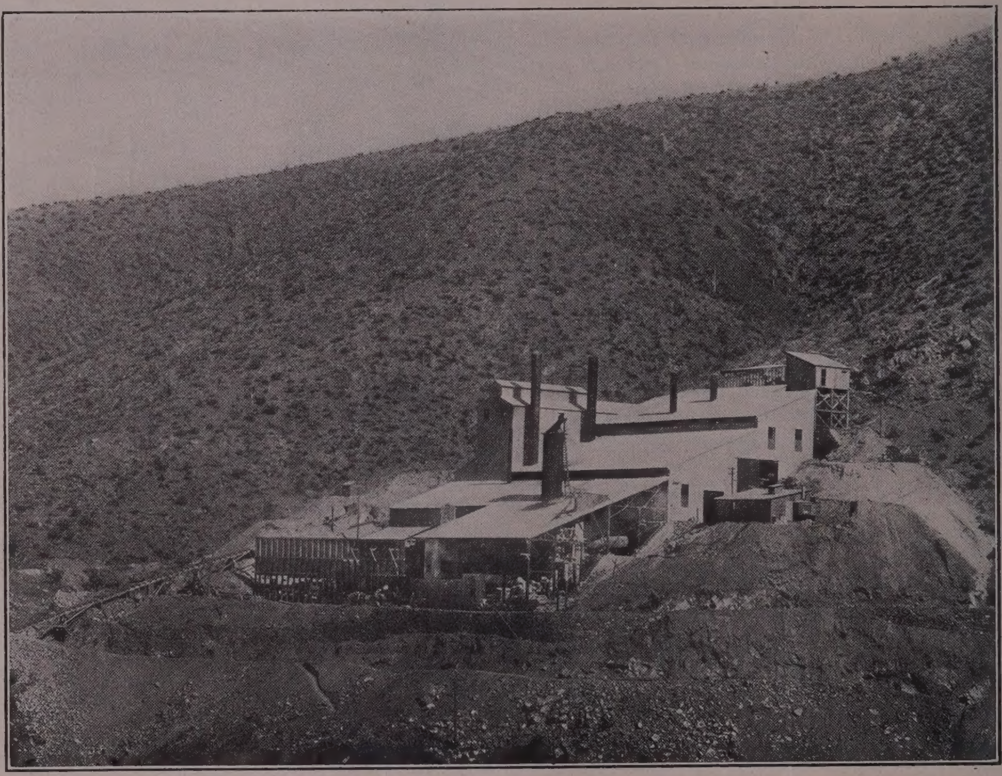
(4) The Leonard system, in which direct-current motors are fed from motor-generators on the locomotives, the latter receiving single-phase alternating current from the power station, either direct or through transformer sub-stations along the line.

(5) Polyphase system, in which three-phase alternating-current induction motors on the locomotive are fed from three-phase transformer sub-stations along the line, which receive three-phase alternating current from the power station.

The advantages, disadvantages and limitations of the various systems are as follows:

(1) Direct Current.—Propulsion by direct-current distribution direct is limited to short distances on account of the low limiting pressure of 600 volts, which makes the cost of copper prohibitive for heavy traction over average distances. Other things being equal, the weight of copper required is inversely as the square of the voltage. The collection of the large amounts of current required with a larger electric locomotive, frequently amounting to 2,000 h.p. at starting, becomes extremely difficult, if not impossible, with an overhead feeder in a 600-volt direct-current system, so that recourse has to be taken to the third rail. The objections to the latter are so numerous and are so well known that they need not be gone into in detail, except to mention that the third rail is likely to cause accidents to section men, increase cost of maintenance, and in case of a slight derailment, its presence might result in serious damage and the blocking of road for a considerable length of time. It is, indeed, true that the wrecked portion might be isolated, as regards danger, by cutting off the current; it would also, however, to a great extent, be isolated as regards ability to bring up other apparatus for clearing the track. In fact, if the presence of a third and probably a fourth rail were a necessity in connection with the introduction of electric traction, it is seriously to be doubted whether most of our railway companies would ever be brought to consider it. Other serious drawbacks, such as the comparatively large rheostatic losses occurring at the starting up of motors, also the dangers from electrolysis, might be mentioned as showing the unsuitableness of this system for heavy traction.

(2) Alternating-Direct Current.—In this method of distribution the losses in transmission and the expenditure for copper are avoided by distributing alternating current at a high voltage to sub-stations placed at convenient distances, in which are installed step-down transformers and rotary converters which convert the alternating current of lowered pressures to 600-volt direct current feeding into trolley of third rail. This is the system adopted by the New York Central, and is the one installed by the Lancashire & Yorkshire Ry. on its double-tracked 23-mile line between Liverpool and Southport. Alternating-current three-phase power is generated for this road at 7,500 volts, of a frequency of 25 cycles, and is transmitted from a power house to four sub-stations, which step-down the high tension current to low tension alternating current, from which it is converted in rotary converters to direct current at 600 volts. This power is fed thence through feeder conductors to the third rail, and returned by the fourth rail, bonded to each running rail by return feeders.


Government Cement Plant for Roosevelt Dam.

The drawbacks to the previous system apply equally to the direct-current part of this system, and in addition there are the disadvantages of the sub-stations containing the direct-current rotary converters which, being revolving machines, require manual attendance, entailing a large initial expenditure and a large operating staff, as well as increase the liability to break down by the introduction of another link in the electric circuit.

In view of the various disadvantages, as mentioned in the foregoing, it might be interesting to look into the reasons for the adoption by the New York Central R. R. of this system. The reasons for their action, it would appear, were those of policy, as well as engineering. The word policy in this respect refers to the idea that the system adopted should leave every opportunity for the possible future interchange of equipment with other local systems, including the rapid transit lines. The relative costs of the alternating and direct-current systems were in favor of the direct-current equipment, and a further objection to the alternating-current system was the use of an overhead construction of bare wire in tunnels and viaducts, which included liability of injury to trainmen as well as a tendency to corrosion of wires from the gases of freight steam locomotives. Among other points was the fact that the alternating-current locomotive would have a greater weight, thus adding 7 to 10 per cent. to the train weight, with a consequent increased cost of transmission, installation and operation of power plants. Further, the cost of maintenance of alternating-current apparatus would be greater. The depreciation would also be greater, due to the equipment being more novel, and more or less untried, and would, therefore, have to be discarded in the near future to make room for improved types, whereas the direct-current apparatus, being standardized and universally in application, would prove a good asset.

(3) The single-phase system to-day is, in the opinion of the majority of engineers, the one which is essential for heavy and long-distance railway service, and conforms to the ideal requirements for electric traction. The development of the system has only become prominent and made possible within the last two years, due to the fundamental feature of the system, the single-phase commutator motor, having been brought to a high degree of perfection for railway work. It should be borne in mind that the advantages accruing from this system are due primarily to the use of alternating current, rather than to any advantages of the alternating-current over the direct-current railway motor, though it should be noted that it has equally good characteristics and is almost as efficient.

View from High-Line Road Looking down on Cement Plant and Camp, Salt River Valley.

The credit of the many advantages gained with this system, however, must be given to the alternating-current railway motor since its development has made the exclusive use of single-phase alternating current on railway systems practicable.

The details of one of the several single-phase roads now operating are as follows: Power is generated at 2,200 volts, and in the power house, by means of static transformers having no moving parts, transformed to 33,000 volts. At this voltage it is transmitted to transformer stations located every 10 or 12 miles along the line, where it is reduced to 3,300 volts and fed to the trolley. The transformer stations require no attendants, as the feeder lines are all controlled from the power house and the stations have no apparatus with moving parts. The 3,300-volt trolley current is carried into the car by a bow trolley, and through a static transformer in the car reduced to 250 volts, for which the motors are designed. This is an extremely flexible system; by making changes in the transformers, which are not expensive and always good assets, the transmission voltage or the trolley voltage can at any time be changed to meet the requirements of new conditions which may arise. The trolley voltage could be increased to 6,000 volts, which would give sufficient power for operating 100-ton locomotives, with the same size trolley wire in use. In order to protect passengers and crew from the high pressure used in this system all car wiring is placed in metal conduits and connected to trucks, so that should any defect in insulation develop it will result in the tripping of the automatic circuit-breaker in the car or locomotive.

With the single-phase alternating-current system the overhead conductor and its many advantages are retained. There are objectionable features to its use, some of which may be named as follows: (*a*) Difficulty of securing headroom through tunnels under bridges as existing structures. These have been eliminated by using a third rail. (*b*) Snow and ice will collect on the trolley wire. This has been overcome, with more or less success, by coating the wire with various solutions or greasing it, by supporting the wire from underneath and collecting the current from its top, as is done in several Swiss installations, or by passing a heavy low-voltage current through the wire, raising its temperature. (*c*) Poles and guy wires breaking and allowing the trolley wire to fall, or breaking of trolley wires. These latter objections are possible to avoid by better construction which has been introduced with the single-phase railway, and consists of a catenary suspension cable or cables supported on insulators on suitable brackets from the poles, the trolley wire being suspended at intervals of 10 to 12 ft. from steel cables; this method of suspension allows the trolley wire being kept at a uniform height above the tracks. For heavier service steel bridges spanning the tracks and carrying the suspension cables may be used. Liability of a break occurring is reduced to a minimum by using two cables.

A summary of the principal advantages of the alternating-current electric traction over the direct-current are: (1) Limits to trolley voltage are removed; (2) avoiding of rheostatic losses; (3) no necessity for rotary converter sub-stations with manual attendance; (4) danger of electrolysis by return current avoided. These and other advantages are so well recognized by engineers that this form of electric traction is now being taken up in England, Europe and South Africa, as well as on this continent. The Swedish Government Railways have purchased equipment and are making experiments with trolley voltages up to 18,000 volts and eliminating the use of sub-stations with step-down transformers for lowering transmission voltage to a lower trolley voltage. In South Africa the government has recently placed an order for the equipment of one of their main lines with this system.

(4) The Leonard system is in reality a form of the foregoing system, and involves the supply of single-phase current to an alternating-current motor on the locomotive, the motor in turn driving a direct-current generator. This generator furnishes current for the operation of the car motors. By varying the voltage of direct-current generator by means of a rheostat, any desired voltage may be obtained on the motor-supply circuit, thus obtaining a perfectly smooth and rapid acceleration with minimum energy from the supply circuit, and the starting of a locomotive does not produce a peak in the load diagram. Such a system, while it may be feasible in the case of large locomotives, yet does not furnish a general solution of the railway problem, as the arrangement is not flexible enough. In the ideal system the same method of operation and the same types of apparatus should be used on the feeders or branch lines as on the main lines, if full benefit is to be obtained by electrification.

(5) The polyphase system has been developed by European engineers, and a number of installations have been made in Europe. American engineers consistently refuse to adopt the polyphase induction motor for the following reasons: (*a*) The motor is inherently a constant-speed one and therefore not adapted for traction work; at one definite speed only is the polyphase motor efficient. One expedient used to overcome this is to run motors in concatenation or tandem, which gives a second speed at one-half of normal speed. By winding motors for a diffierent number of poles, more than the two speeds may be obtained, but this arrangement has the disadvantage of being able to use but one-half of the total motor capacity above half speed, while the greatest expenditure of energy takes place above that speed. (*b*) The necessity of providing for at least two overhead conductors. (*c*) The fact that motors must be built with small air gaps to give most efficient results. The advantages of the polyphase motor for traction purposes are as follows: In contrast to the single-phase motor the tractive effort at starting is greater. This is due to the fact that in the single-phase motor the torque is not constant, but varies between a maximum and zero with double the frequency of the line current. The mean value of the torque is only one-half of the maximum torque when slipping wheels, which means where the tractive effort required necessitates going to the limit of adhesion between wheels and track, a single-phase locomotive must have almost twice as much weight on drivers as either a direct-current or three-phase locomotive. This difference holds true only for motors mounted di-

rectly on car axles, and will be somewhat less if geared. The weight of a three-phase motor is only about three-quarters of the direct-current motor of equal capacity, and approximately one-half that of a single-phase motor, and the cost is also less. The cost of equipment is also made lower, as the transformers on the locomotive may be dispensed with, as motors of this type are now made for operation direct on voltage up to 10,000 volts. The three-phase motor is probably the most robust and thoroughly mechanical piece of machinery extant, and its maintenance would be less than with any other system.

Generally speaking, the conditions most favorable for the adoption of this system are rare, and occur when the lines are long, when there are few trains with few stops, and when the lines have long and regular gradients, particularly if there is plenty of motive power and it is cheap. In the case of mountain railways, the polyphase system has a special advantage in that power may be returned to the line when running down hill, the motors acting as generators and thus allowing of the electrical braking of trains.

While the wholesale retirement of the steam locomotive in favor of its electrical competitor cannot take place in the immediate future, owing to capital now invested, there are many isolated sections of steam roads in the operation of which electric traction could effect economies which would well pay for its adoption. These economies may be in the direction of a reduced fuel, labor and maintenance account, but may be more far-reaching and warrant changes in the present method of operating by steam. The millions of dollars contemplated for reducing grades and double-tracking certain sections of single-track roads in order to increase their capacity with steam locomotives might be spent with promise of greater return if used for installing electrical equipment.

The Nernst Lighting System developed for small cities involves the use of 440-volt, single-phase, 60-cycle generators with the usual accessories in a centrally located power plant. The generators are provided with a neutral connection in addition to their main terminals, which permits the use of a direct-connected three-wire 220-440-volt feeder system. The lighting and power load is then supplied direct from these feeders through two-wire 220-volt mains, one side of which is connected to the neutral and the other to one of the outside wires of the feeder circuit, the load being divided evenly between the two sides of that circuit.

A Pipe Line Accident Due to a Broken Air Valve.

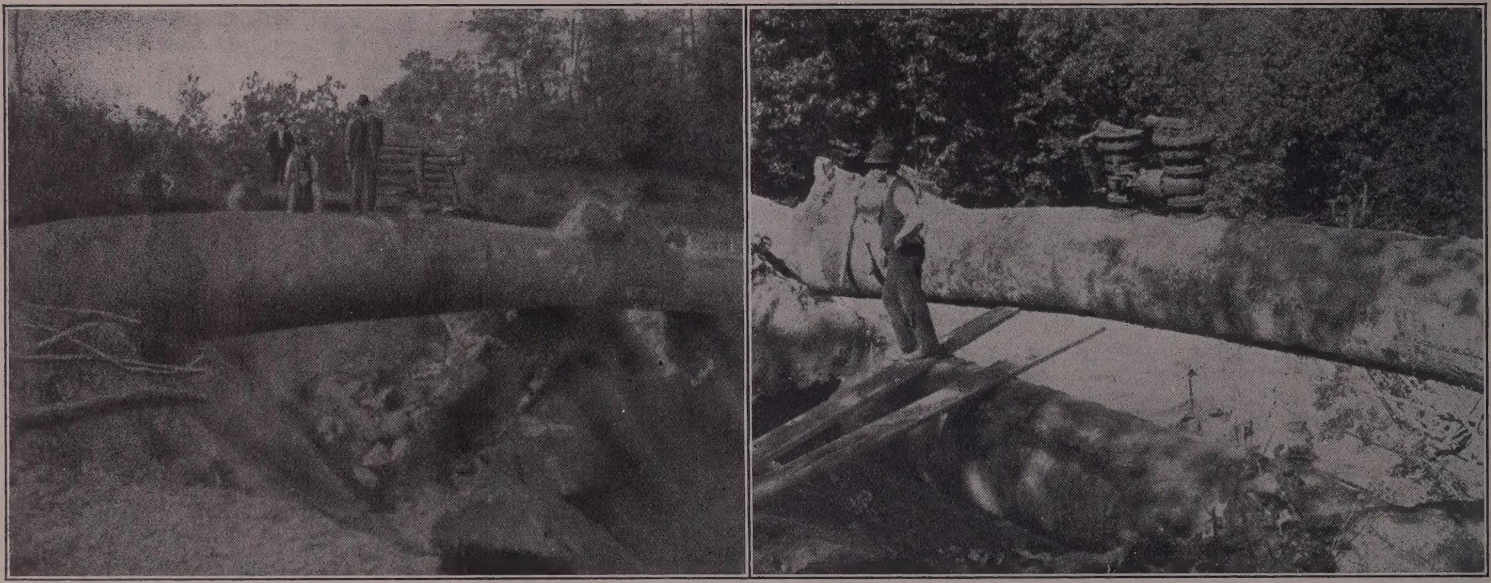
A washout that occurred September 23 on the conduit line of the Newark, N. J., water works severely tested the 42 and 48-in. riveted steel pipes from the Pequannock watershed to the distribution reservoirs in Newark. The accident was due to the breaking of an air valve, a hole 25 ft. deep, 50 ft. wide parallel with the pipe line and 150 ft. long transversely to it, being washed out. The pipes, which were running full at the time, were thus left unsupported over a span of 50 ft., but neither of them was damaged at all, it being considered that a slight arch made in both pipes when they were laid helped to support them. As soon as they could be shored up temporarily they were placed in service again and more permanent repairs undertaken afterward.

Both pipe lines are about 21 miles long and were laid by the T. A. Gillespie Co. for the East Jersey Water Co., the 48-in. one in 1891 and the 42-in. one in 1896. The accident happened about 6 miles from the Macopin intake on the watershed at a place where the pipes pass over a summit on a short sandy point at the edge of a high hill. With certain heights of delivery in the city the conduits do not flow full, but when they are flowing full a pressure of about 60 lb. exists at this summit. One 10-in. and one 8-in. air valve are placed on each pipe at the summit to remove any air that may collect there and to provide for the irregularity in flow. The valves are of a form provided with a cluster of cups in the valve bonnet, and are designed to close as the pressure rises and the pipes flow full. There is necessarily always more or less water slopping over as the valves close and a slight washout was caused by this waste water at this point about three years ago. The pipes are made of ¼-in. plates and are 12 ft. apart in this portion of the line. A separate masonry chamber was built around the pair of valves on each pipe to prevent any further difficulty after the first washout, a 6-in. drain being laid from these vaults. The pressure was increased on the afternoon of the accident and in some manner one of the valve cups was broken, leaving an orifice 2½ in. in diameter discharging under about 60 lb. pressure. The sand in the hill is very fine and readily flowed away with the stream from the pipes, undermining the latter as mentioned and causing the valve chambers to break off and fall down into the excavation.

The accident was not reported to the city engineer's office immediately, so the pipes carried the full flow of water across the 50-ft. span for over 2 hours. The supply from the watershed was shut off and the conduits drained as soon as possible after the report of the accident was received, but it was several hours after the undermining began before the water could be drawn out entirely. The distribution system was supplied until repairs could be made with water from the Cedar Grove storage reservoir, described in The Engineering Record, December 5 and 12, 1903. This reservoir was completed in August of this year, and as one of its principal objects was to provide water in case of accidents to the pipe lines, the recent washout has already demonstrated its usefulness and necessity.

A force of men had started about an hour before the accident occurred on a regular trip of inspection of the blow-offs and air valves at the depressions and summits along the line, and they began to make temporary repairs at once. The pipes were supported on bents made of telegraph poles with heavy timber caps. The soil in the bottom of the washout was exceedingly treacherous, but portions of the masonry of the valve chambers made a fairly stable footing for the bents. One of the conduits was braced thoroughly enough at the end of two days so that it was put in service again, while the second one was ready for service in four days after the accident. Material has been filled in around the bents, and temporary valve boxes have been built around the valves, with large sheet-iron drains leading down the side of the hill to safely carry away the waste water. The summit and air valves are to be eliminated by lowering the pipes 18 ft. across the sand hill and by laying 600 ft. of new pipe.

Three similar accidents occurred on these same conduits in October, 1903, due to heavy floods. Those accidents and the methods of supporting the pipes until repairs could be made were described in The Engineering Record January 23, 1904. Mr. Morris R. Sherrerd, city engineer, of Newark, who supervised the repairs at that time and also those of the present washout, furnished the information and photographs for this article.



Views of Steel Pipes Remaining Undamaged over Fifty-Foot Washout.

A Monument to Gramme, a pioneer in the development of dynamo electrical machinery and the inventor of the ring type of armature, was erected at Liege, Belgium, recently. Gramme made many discoveries in applied electricity and perfected an alternating current dynamo in 1867.

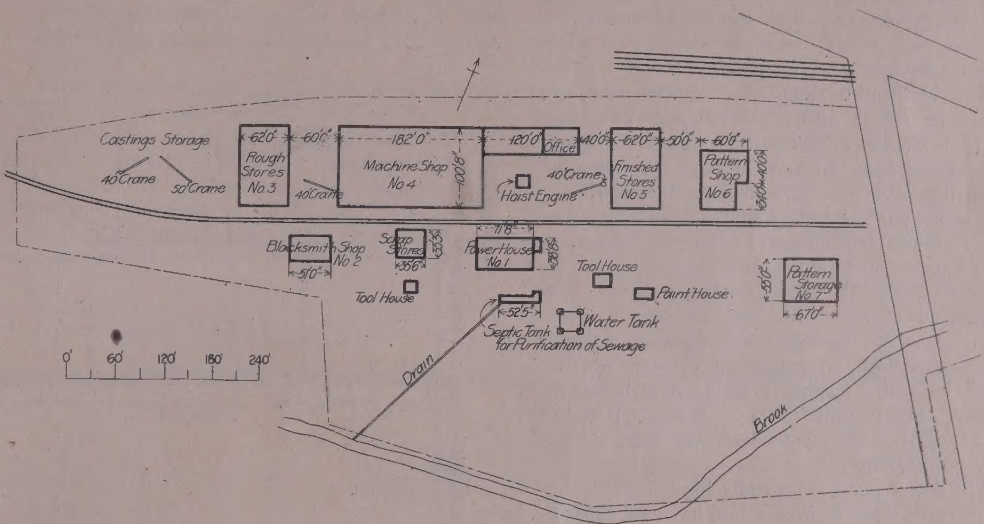
The New Shops of the Watson-Stillman Co.

The Watson-Stillman Co., of New York, has recently occupied a model plant for manufacturing hydraulic machinery at Aldene, N. J. Driven from its quarters long occupied in New York, which offered no opportunity for the expansion demanded by the development of the business, the company secured the plant formerly occupied by the Jackson Architectural Iron Works, at Aldene, which was remodeled in detail and extended as necessary. The building equipment, which then included only the main shop building and the power plant, was well adapted for the purposes of the new owners with comparatively slight alterations, and the various other buildings of the present plant were added. The company had occupied the new plant barely eight months, however, when a disastrous fire occurred on Nov. 9, 1904, in the main machine shop, almost entirely destroying that structure and contents. The fire came at a particularly unfortunate time as many heavy contracts were then under way, most important of which were the hydraulic jacks to be used for moving the shields in the construction of the Pennsylvania R. R. tunnels under the Hudson River. In less than ten days, however, some of the machinery was running, while in six weeks the main shop was again under cover. In less than four months work was resumed in full, with new tools and equipment, and under even more favorable conditions than before, the machine shop structure having been rebuilt, to practically the same dimensions, in record-breaking time.

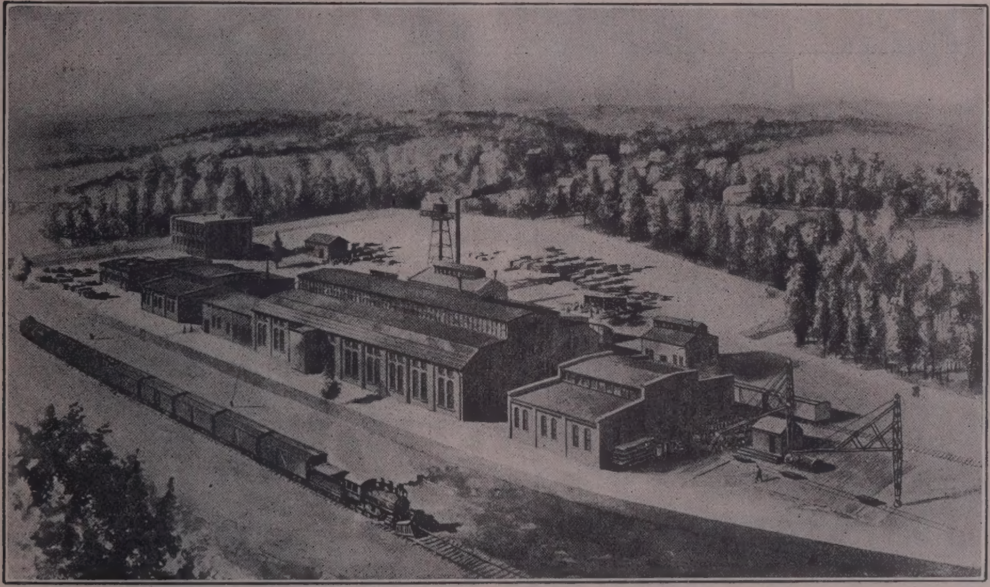
The location at Aldene is 15 miles from the New York city hall on the Central R. R. of New Jersey, where excellent connections are to be had with three of the trunk roads entering New York terminals. The site comprises about 15 acres, along the railroad for over 1,500 ft., and comprises dry ground in the main, with excellent drainage to a creek passing through the rear of the property. The buildings cover less than half of the property, so that there will be unexcelled opportunities for expansion. The water supply is from wells. The yard is served by a switch from the Lehigh Valley R. R., which passes close to each of the buildings, as shown in the plan. The plant is, in fact, laid out in reference to this longitudinal track, an arrangement of buildings having been secured which permits the passage of all material forward in a direct line from the castings and rough material stores, through the manufacturing departments to the finished stores. This results in a long, narrow yard and building plan, yet one which is favorable to a convenient building arrangement. The stores and manufacturing buildings are arranged in a row along the northerly side of the longitudinal track, beginning with the castings storage yard and rough stores building, next the main machine and erecting shop, and lastly the finished stores building. Beyond this is the pattern shop, while further, across the track in an isolated location, is the pattern storage. On the opposite side of the track from the main shop is the blacksmith shop, the scrap storage, the power plant and paint and oil storage.

The machine shop, the rough and finished stores buildings and the power house are of steel frame and brick construction, while the pattern storage is of mill construction. The former buildings are all laid out parallel to the track, thus permitting longitudinal extension with ease. The rough and finished stores buildings, which are identical in construction, were laid out in line with the machine shop, and, like the latter shop, are each 100 ft. wide, divided into two 30-ft. side bays and a central 40-ft. bay. In the side bays of the stores buildings there is 12-ft. clear headroom beneath the trusses, while the middle bays have 18 ft. clear headroom. These buildings have floors of 3-in. squared-edge hemlock laid on 5 in. of tar cinder concrete. The roofs are of four-ply slag on 2-in. tongue-and-groove pine.

The machine shop was formerly a flat roof building without galleries or monitor, both of which were added. It is now 100x182 ft. in floor area with a clear height in the central bay of 31 ft.; like the stores buildings, the structure has a central bay, 40 ft. wide and two 30-ft. side bays, each of the latter having a gallery 15 ft. above the main floor level, while above them there is a clear headroom of only 7½ ft. beneath the lower chords of the roof trusses; ample room for shafting, etc., is, however, provided above this, so as to be out of the way. The monitor over the main bay rises 11 ft. above the roof level over the side bays. The galleries are each well lighted by a line of skylighting extending the length of the inclined outer edge of the roof above.



Yard and Building Plan of the New Watson-Stillman Plant at Aldene, N. J.



Birds-Eye View of the Watson-Stillman Plant.

The details of the steel framework of the main shop are indicated in the half cross-section. The ten wall and crane posts are 20 ft. apart, the 20-in. solid web crane posts being supported on concrete piers. The roof covering is four-ply slag upon 2-in. tongue-and-groove pine. The crane posts carry 20-in. I-beam runway girders, 24 ft. above floor level; these girders carry 6x4x⅜-in. channels, to which the runway-rail clips are bolted. The gallery flooring is supported by 15-in. 33-lb. I-beams spanning the side way between wall posts and crane posts, between which are 12-in. I-beams, 5 ft. 9 in. apart. The flooring in the gallery is of ⅞-in. maple on 3-in. tongue-and-groove hemlock, while the main floor is of four and six-in. concrete laid on 5 in. of tar cinder concrete.

The main floor, both under the galleries and the central bay, is devoted to the machine tools, testing apparatus, etc., required for the heavy work of manufacturing, the central bay where heavy erecting work is carried out being served by a 10-ton Niles traveling crane. This crane has a span between runway rails of 37 ft., and is operated by three-phase induction motors. The crane is made to serve the galleries also by means of two 6x26-ft. platforms extending out from either gallery without railings, thus facilitating the handling of heavy parts to and from the gallery. In the galleries are located the lighter classes of tools, such as the milling machines, 20-in. engine lathes and smaller, the speed and turret lathes, and the tool room, small erecting and repair departments, etc. The tool room is partitioned off in the south gallery by an enclosure of woven-wire netting hung on a pipe railing, which material is also used for the railings at the outside of the galleries. An addition to the main shop, 35x120 ft. in size, projects toward the finished stores, and accommodates additional tools and storage, as well as the temporary offices for the clerical staff at the works. The engineering department is at present located in the finished stores building, but will be provided for with modern and convenient quarters in a new administration and office building soon to be built near the street entrance to the yard.

The pattern shop is 60x74 ft. in size, embracing a carpenter shop, pattern shop and dry lumber storage, and is of light wooden construction. The 50x65-ft. pattern storage building is of mill construction. Pattern racks are provided on two floors, between which there is an elevator to facilitate handling. The racks consist of shelves made of woven-wire netting, secured to frames of 1¾-in. angles, the frames being supported by vertical posts of 1½-in. piping. A feature of this style of shelves for pattern storage is the accessibility in case of fire; water may be thrown from the hose into all parts of the room from outside the windows, without the interference to the stream that would result if wooden or sheet metal shelving were used.

The blacksmith shop is a wooden structure 30x50 ft. in size with a concrete base extending 30 in. below the ground surface and 30-in. above, its purpose being to keep the wooden siding up from the ground, so that pieces of hot iron lodging against the outside walls will not cause fire. An additional advantage is secured, however, in that a good foundation is available if it is ever desired to change the superstructure to brick. The equipment of the smith shop includes a steam hammer, crane facilities, a Fergusson fuel oil furnace, and an oil tempering furnace, while a large hydraulic forging press is now being installed. The fuel oil for the oil furnaces is stored in a 7x33-ft. tank located near the west side of the smith shop.

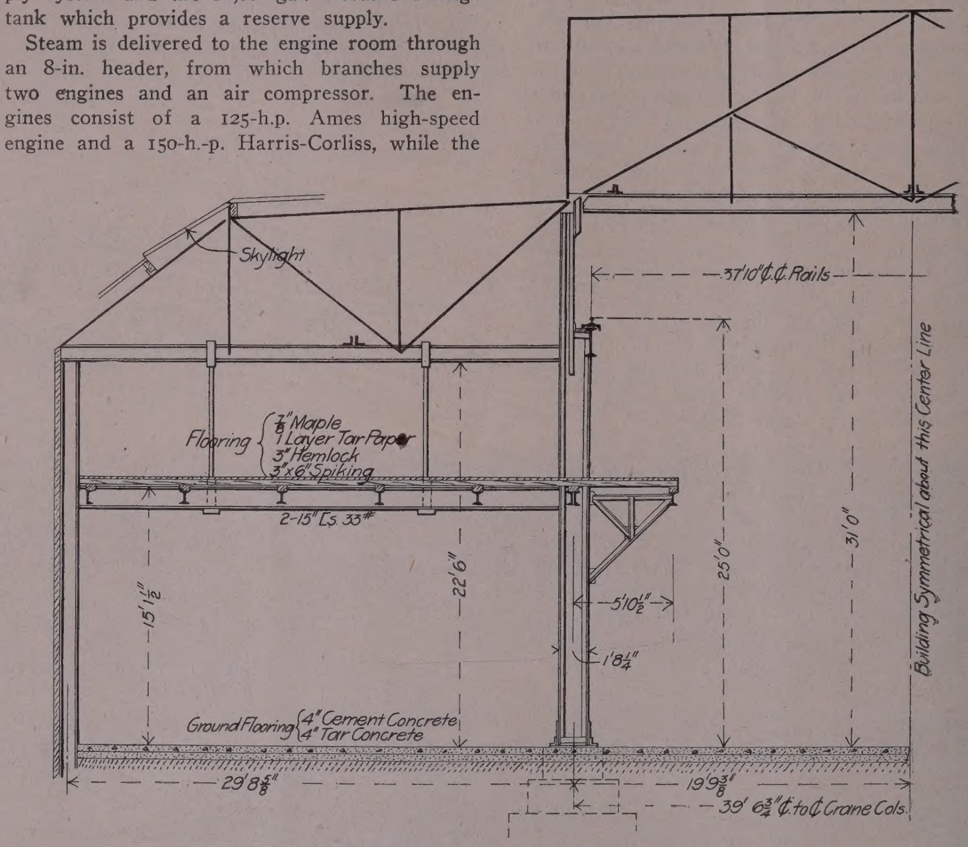
The power plant is centrally located, occupying a structure 38x70 ft. in size, and having a capacity of about 300 h.-p. The structure is of brick with steel roof trusses, giving a clear headroom of 16½ ft., and is divided by a brick wall into boiler and engine rooms of equal size. Ample lighting and ventilation is afforded by an 8x12-ft. monitor, extending the length of the roof, which has a covering of slate on terra-cotta book tiles for fireproofing.

The boiler plant consists of a Worthington and an Edgar watertube boiler, each rated at approximately 150 h.-p. Both are operated with plain hand-fired grates, draft being supplied by a 44-in. steel smokestack, 90 ft. high. The Edgar boiler has 760 1-in. vertical tubes 8 ft. long, connecting the mud and steam drums, each 40 in. in diameter and 12 ft. long. There are two furnaces, one of 40 sq. ft. grate area on either side of the tubes, and each of them has a large combustion chamber above, rising full area to a height of 11 ft. The gases make only a single pass through the boiler tubes before entering the breeching, yet their temperature is reduced to about 500° Fahr. before entering the breeching. The total water heating surface is 1,500 sq. ft., and, when forced, the boiler has proved able to carry overloads up to 75 per cent. The other boiler is of the standard Worthington marine water-tube type, with a 40-in. by 10-ft. steam drum and 175 3-in. tubes, giving a heating surface of about 1,200 sq. ft. It has a grate area of 42 sq. ft.

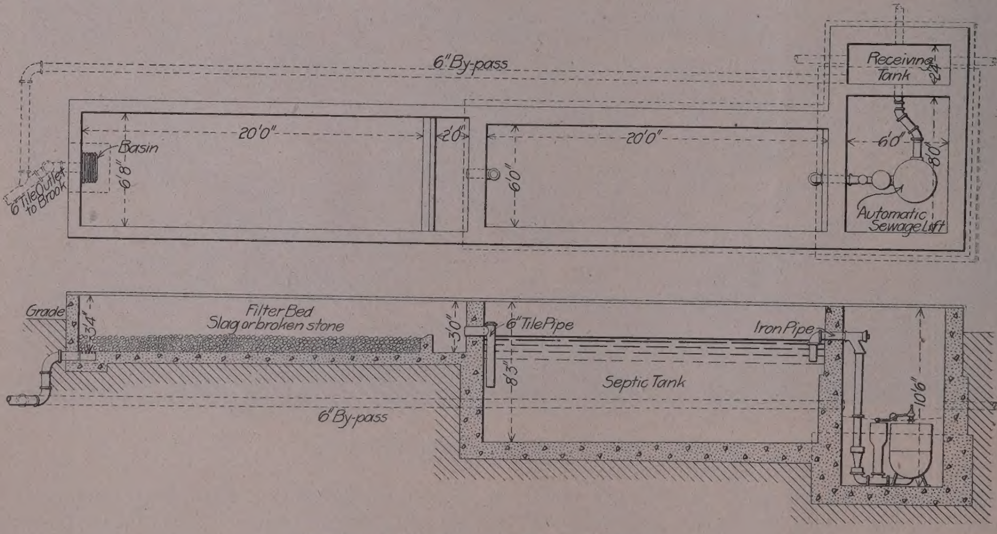
The boilers have a duplicate feeding system comprising a 6x4x6-in. Worthington boiler feed pump and a Penberthy single-tube injector of 300 b.h.p. capacity. A Worthington water meter is used to measure the amount of water fed to the boilers, which is recorded on a special power plant log, together with the amounts of coal used, feed water temperatures, etc. There is a 300-h.-p. Berryman closed heater, to which is connected the exhaust line from the engines and pumps, and the drips from the steam piping. Considerable trouble has been experienced from scale-forming impurities in the feed water, requiring the use of considerable quantities of Solventine in the boilers, as a consequence of which a Harrisburg open feed-water heater and purifier has recently been installed. This open heater, which has a capacity of 9,000 lb. of water per hour, nominally 300 h.-p. capacity, has trays for the deposition of scale matter and filter equipment, and was supplied by the Harrisburg Pipe & Pipe Bending Co. There is also in use a damper regulator operating a damper in the breeching, and an 8x5x12-in. Davidson service pump delivering to the general shop water supply system and the 22,000-gal. elevated storage tank which provides a reserve supply.

Steam is delivered to the engine room through an 8-in. header, from which branches supply two engines and an air compressor. The engines consist of a 125-h.p. Ames high-speed engine and a 150-h.-p. Harris-Corliss, while the air-compressor is an Imperial double-engine, two-stage compressor built by the Rand Drill Co. The Ames engine has a 13x12-in. cylinder, operates at 300 r.p.m., and is belt-connected to a 75-kw. three-phase General Electric alternator while the Harris-Corliss engine, with a 12x36-in. cylinder, operates at 120 r.p.m., and is belt-connected to a 180-kw. Westinghouse three-phase alternator. The compressor has 10x16-in. steam cylinders, while its air cylinders are respectively 10 and 14 in. in diameter.

The electrical distribution of power is carried out on the three-phase alternating system, the circuits being operated at 220-volts and a frequency of 60 cycles. There is about 200 h.-p. capacity in three-phase induction motors distributed throughout the various departments, the group system of machine tool driving being used exclusively. The motors used are confined to the three sizes of 5, 10 and 15 h.-p. capacity; when any line shaft becomes overloaded, so that the 15-h.-p. motor cannot easily handle it, the line is cut into two sections and each of the latter equipped with a 10-h.-p. motor. The hangers for the group line shafts are bolted to a pair of channels, which are in turn secured to the I-beam roof members, so that the line may easily be moved in its entirety. The power circuits in the main shop are controlled from a special switchboard at the point of feeder entry, the power house board being used mainly for generator control and the feeders. A direct-current auxiliary circuit of light capacity is run from the exciters of the generators to various sections of the machine shop for the operation of



Half-Cross-Section of the Main Shop Building.



Details of the Sewage Disposal System.

electrical center grinders, small electric drills, etc.

The entire plant is heated in winter by exhaust steam from the engines, pumps, etc., by the Webster system. The exhaust line is carried to the main shop in an 8-in. main which distributes to numerous radiators and pipe coils, upon each of which there are one or more of the Webster automatic return valves. The drips from these are led to a Knowles vacuum pump, with 5-in. steam and 7-in. vacuum cylinder and a 12-in. stroke, which ordinarily easily maintains a vacuum of 20 in. on the drip lines from the radiators; the result of this is to keep the back-pressure imposed by the heating system upon the engines down to less than 3 lb.

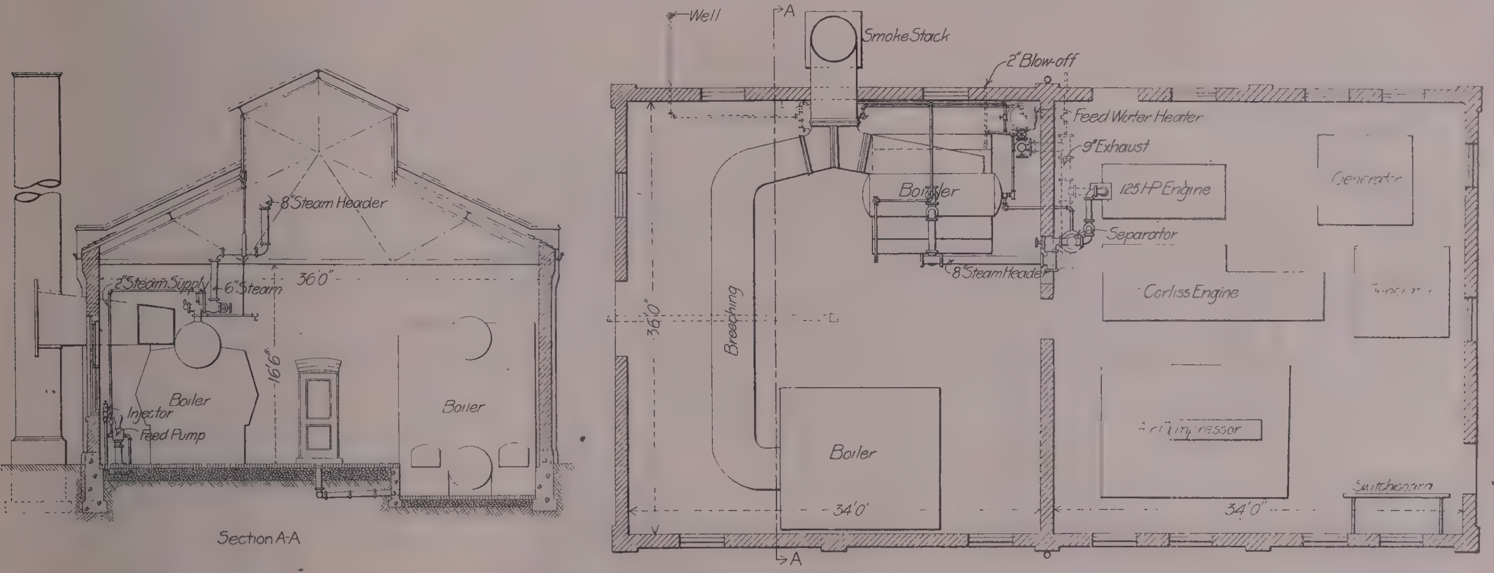
An interesting auxiliary feature of the shop plant is the local sanitary system in use. Owing to the lack of outside sewerage facilities and restrictions against the discharge of sewage into the adjacent creek, a septic tank was installed. The sewage is led to a receiving pocket at the rear of the power plant where an Ellis automatic sewage lift raises it about 4 ft. to the higher level of the septic tank, as shown in the detail drawing. The septic tank is 6x20 ft. in area, and has an overflow so arranged as to maintain the sewage level at 6 ft. 3 in. The effluent from the tank passes through a filter of broken stone, 7x20 ft. in area and 1 ft. deep, passing thence to a drain to the creek. The results obtained with this plant have proved very satisfactory, the discharge entering the creek in a perfectly clear and colorless form, and entirely free from any odor.

The concrete septic tank, receiving tank and filter bed were built as one unit, with the top of the enclosure 18 in. above the grade of the shop floor. The various sewers enter the receiving tank about 4½ ft. below this grade, the Ellis sewage lift being used to raise it up to the shop floor grade in the septic tank. The lift is located in a pit 10 ft. 6 in. deep so as to bring it below the outlet level of the receiving tank. The overflow connection from the septic tank delivers from a point 3 ft. below the surface of the sewage so as to prevent any disturbance of the surface scum.

An unusually complete system of local fire protection has been arranged by the employees of the works, which has meritorious features. About 35 picked men in the works compose the local fire department, which is headed by Mr. A. P. Fowler, a draftsman of the company. They are divided into two groups, one a hose gang and the other a ladder gang, each with a captain who reports to the chief. Each member has a specific duty to attend to in case of alarm of fire for any of the buildings, so as to avoid confusion, and substitutes are prepared to take the places of absentees. The alarms of fire are sounded either on the power plant whistle or an a bell, the number of taps indicating the building of the plant, each of which is numbered, as indicated on the plan. The hose cart and fire supplies are located in a shed adjacent to the power house. There is to be installed for this department a fire underwriters' pump with an 8-in. longitudinal main extending alongside the entire group of buildings with hydrants so placed as to allow any building to be covered. Further precautions against fire consist of the location of chemical fire extinguishers in all buildings, extinguishers being housed in boxes lined with hair felt where freezing in winter would otherwise be possible.

The organization of the shop has been brought to a high standard and the latest practices prevail from the offices to the stock room. In the latter a most thorough, yet simple, method of storing rough and finished parts in bins is in use, the locations of which are carefully recorded in a special card index system for both stock and locations. The bin system consists of lettered ranges of sectional bins, the pockets being numbered serially so that locations are definitely traced, while bar and tubing stock are kept upon lettered racks consisting of vertical 8-in. channels with 6-in. cross channels. An efficient checking-out system is in use at the tool room and the time of machinists traveling to and from this department to secure tools is saved by a local telephone system centering at the tool room, with branches in close proximity to every tool in the main shop. Communication between departments is supplied by a telephone system with a central at the main office, which has branches in the offices of each of the foremen in the various buildings. The operation of the plant comes directly under the charge of Mr. Charles Howells, superintendent, with offices at the works. Mr. Carl Wigtel is chief engineer in charge of the drafting room, and Mr. Geo. L. Gillon, treasurer and chief of the New York offices at 46 Dey St., who, with Mr. Howells, report to Mr. F. H. Stillman, president of the company.

The plans for the reconstruction of the main building of the former plant into the present main shop, together with the designs of the new buildings, including the rough and finished stores buildings, the pattern storage building, etc., are the work of Mr. G. K. Hooper, New York.



Section A-A

The Power Plant at the Watson-Stillman Works.

Two Gas Engine Accidents.

Two interesting accidents to gas engines are described in the report for 1904 of Mr. Michael Longridge, chief engineer of the British Engine, Boiler & Electrical Insurance Co., of Manchester. The first accident happened to an engine with an 18-in. cylinder, 24-in. stroke, and speed of 130 r.p.m. It was running on town gas and was nine years old. The shaft, which had four bearings and two flywheels, broke through the crank pin. The pin was 6½-in. diameter by 8-in. long, the bearings on each side of the crank were 6½-in. diameter and 12-in. long, and the distance between their centers 35 in. The initial pressure on the piston was 350 lb. per square inch, of which about 40 lb. per square inch would be required to impart velocity to the moving parts, leaving about 310 lb. per square inch of piston area, or 79,000 lb. as the load upon the crank pin at the beginning of the stroke.

Taking the shaft as a beam 6½-in diameter and 35-in. long, loaded in the middle with 79,000 lb., the stress at the middle of the pin will be 25,000 lb. per square inch; while if the length of the beam be assumed to be only 23 in., the distance between the inner ends of the bearings, the stress will be 16,500 lb. per square inch. And besides this the pin at the beginning of the stroke had to bear a part of the stress exerted by the flywheel on the side of the crank remote from the belt driven, for this wheel is then driving part of the load.

The stresses on the shafts of gas engines are not easily amenable to calculation, Mr. Longridge points out, especially where there are more than two bearings; but even when there are only two the calculations are laborious and generally imperfect owing to lack of data. For the stresses are modified by the tension of the driving belt, generally an unknown quantity, and the direction of its pull being greater when the driven drum is behind than when it is in front of the cylinder. They are also modified by the number of flywheels, being less with two than with one, and by the position of the heavier sides of the wheels relatively to the cranks if the wheels be out of balance, weights opposite the cranks increasing the stresses on the crank pins

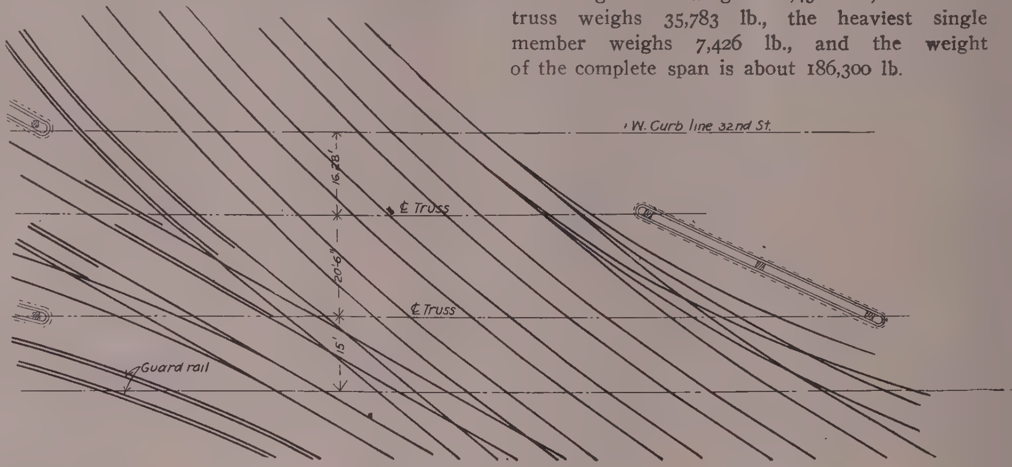
The second accident happened to a single-cylinder engine, six years old, supplied with Dowson gas; cylinders, 11½-in diameter by 18-in. stroke; speed, 180 revolutions per minute. The big end of the connecting rod was of the marine type, with a cap secured by two ⅞-in. steel bolts screwed with Whitworth threads, nuts and lock nuts. One of these bolts broke at the root of the screw thread. The cap was torn off, the other bolt and the rod were bent, and the piston, cylinder liner, and bed plate broken. The cause of the breakage was probably repeated blows owing to slackness of the big end brasses, for the inspector in whose district the engine was frequently complained about it.

During the explosion and compression strokes there is no stress on the connecting rod bolts of a single-acting gas engine, as the rod is in compression, but at the end of the exhaust stroke the force required to arrest the piston and connecting rod is furnished by the flywheel and so the rod and its bolts are in tension. Also at the beginning of the admission or suction stroke the force required to overcome the inertia of the moving parts and start them on their outward course, as well as power required to produce the partial vacuum in the cylinder, is furnished by the flywheel, and transmitted by the bolts in tension.

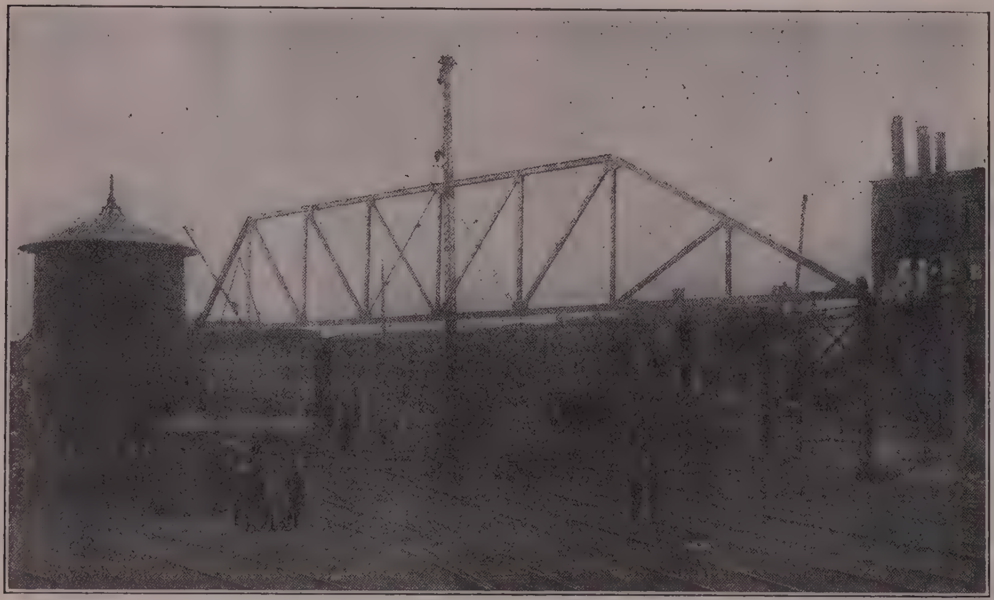
In the case of the engine just referred to these forces probably put a load of about 6,000 lb. upon the two bolts, causing a tensile stress of 7,100 lb. per square inch upon the cores of the screw threads. It is not surprising to Mr. Longridge that a screw thread exposed to many sudden repetitions of such a stress should break. But it is not only to tensile stresses that the connecting-rod bolts of some gas engines are exposed. They have sometimes to resist bending stresses also, which are much more fatal to pieces with abrupt changes of sectional area or screw threads than merely direct pulls. Sometimes the brasses of the big ends of the gas engine connecting rods are planed flat across the backs which fit against the butt ends of the rods and caps. They are not counter-checked into the butts or caps or into each other, but are kept in alignment only by the bolts and crank pin, or if they are slack upon the crank pin, only by the bolts. The bolts in the case of a horizontal engine lie approximately horizontally. The big end of the connecting rod moves up and down as well as to and fro. The force that moves it up and down is transmitted from a crank pin to the brasses, from the brasses through the bolts to the butt end and cap. This force is approximately at right angles to the axis of the bolts, and therefore exerts either a shearing or a bending stress upon them, depending on the fitting of the parts. Having regard to the number of breakages of connecting-rod bolts it is suggested that 7,000 lb. per square inch, which seems to be about the usual stress allotted to them, is too high.

Erecting a Bridge Truss with a Gin Pole.

The spoil from the Eleventh Avenue tunnel shaft at Thirty-second Street of the Pennsylvania, New York & Long Island Railroad Co. is delivered to boats on the North River by cars running on a double-track steel service viaduct. The truss span is required to clear nine tracks and cross overs of the New York Central & Hudson River Railroad which pass under the bridge at a varying angle of approximately 30 deg. with its axis. It was difficult to locate the columns between the tracks, but it was finally accomplished at one end where their center line is at right angles with the axis of the bridge. At the opposite end there are three columns outside of and nearly parallel with the nearest track. The end columns support the ends of the trusses and the center column supports the center of a floorbeam perpendicular to the bridge axis, which has one end connected to the long truss and the other end supported by a column in the line of the short truss. By this arrangement, as shown on the track diagram, it is seen than the span has one end square and one end skewed 43 ft. 8 in. in the width of 20 ft. 6 in. between centers of trusses.



Plan of Tracks Under Bridge.



Lifting Long Truss with Steel Gin Pole.

The short truss has a length of 122 ft. with six 20-ft. 4-in. panels; the long truss is 165 ft. 8 in. long, on centers with six 20-ft. 4-in. panels directly opposite those of the short truss, and two 21-ft. 10-in. panels extending beyond the short truss. Both trusses are of the riveted Pratt type with inclined end posts at the square end of the span. At the skew end of the span the short truss has a vertical end post and the long truss has an inclined end post crossing the two end panels. The trusses are 24 ft. deep and have chords made with 12-in. channels and 16-in. cover plates. The web members all have I-shape cross sections made with two pairs of angles, back to back, latticed and are field riveted to jaw plates shop riveted to the chords. The ends of the vertical posts pass through the chords and are riveted through both connection plates and chord channel webs, thus forming massive diaphragms for the chords. The trusses are connected by the floorbeams, by bottom lateral X-brace angles and by transverse top struts and clevis-ended top lateral X-brace rods. The long truss weighs 60,456 lb., the short truss weighs 35,783 lb., the heaviest single member weighs 7,426 lb., and the weight of the complete span is about 186,300 lb.

Considerable difficulty was experienced in providing for the erection of the span as the railroad company would not permit the use of falsework in the narrow spaces between their tracks under it. Finally space was secured adjacent to the tracks and both trusses were simultaneously assembled on blocking in a horizontal plane about 3 ft. above the surface of the ground in a position nearly parallel to the bridge axis and about 100 ft. from it. The assembling and riveting was accomplished by an average force of sixteen men in eighteen days. When the trusses were completed all traffic on the railroad tracks was diverted for one Sunday and skids were arranged from the trusses across the tracks to the line of the bridge.

The long truss was first pulled, flatwise, on these skids by a hoisting engine and two tackles until its lower chord was approximately in the vertical plane of its required position. Then it was revolved to a vertical plane by a single special tackle suspended from a steel gin pole 65 ft. high, which was guyed with four steel wire ropes ⅞ in. in diameter. The same apparatus hoisted the truss about 50 ft. and seated it on the columns, where it was guyed and released from the tackle. The gin pole was then moved across the width of the span and similarly revolved and hoisted the short truss. Two engines were used and operated the opposite ends of a single line reeved through a set of eight 3-sheave blocks. Four of the blocks were attached to the gin pole and four to a bridle or chain sling enclosing the center of gravity of the girder. This arrangement insured equalization of the stress at all times and secured regular hoisting, no matter whether one or both engines was in operation or whether one engine was operated faster than the other. The floor and lateral systems were erected by a jinniwing moving derrick between the trusses from end to end of the span. About fifty men were employed on the erection, which, including the setting up and rigging up the gin pole, took from 5 a. m. until 11 p. m. The bridge was built by Post & McCord for the New York Contracting Co.

The Riverdale Plant of the Apple River Power Co.

Stillwater, Minn., is supplied with electric current for lighting and power purposes by two hydro-electric generating stations of the Apple River Power Co., on the Apple River, at Somerset and at Riverdale, Wis. The Apple River has its source in 21 small lakes in the northwestern part of Wisconsin and empties into the St. Croix River about 12 miles above Stillwater. The flow of this stream is remarkably uniform owing to the constancy of the lakes at its source, and it rarely overflows its banks, which are only 4 ft. high in places, while its minimum flow is 22,000 cu. ft. per minute. The plant at Somerset is 10 miles from Stillwater and was put in operation supplying electric current to New Richmond, Wis., in 1897. Its machinery equipment was completely remodeled in 1904 and the plant put in service in October of that year supplying electric current to Stillwater. The Riverdale plant was built in 1904-5 and is two miles upstream from the Somerset plant.

The station building at the Somerset plant was formerly a flour mill and the dam, which is connected with the plant, is a rock-filled timber-crib structure, 120 ft. long on top, with an earth embankment at each end. The available head developed by the dam is 16½ ft., the water being carried from the dam to the turbines which operate the electric generators through two timber flumes 10x12 ft. in cross-section and 36 ft. long. The generating equipment consists of two 250-h.p., 2,300-volt, three-phase, 60-cycle generators made by the National Electric Co. One of the generators is belt-connected to a pair of 42-in. special New American turbines of 400 h.p. capacity, made by the Dayton Globe & Iron Works, while the other one is belt-connected to a pair of 42-in. McCormick turbines of 500 h.p. capacity, made by the S. Morgan Smith Co. One pair of turbines is in each flume and the operation of both pairs is controlled by Woodward governors. Current is generated at 2,300 volts, stepped up to 15,000 volts by three 200-kw., oil-insulated, water-cooled, delta-connected transformers, made by the National Electric Co., and transmitted at that voltage to Stillwater over a delta-connected transmission line. The transformers are in a 14x18-ft. stone building, 50 ft. from the station building, and the cooling water is circulated through them by a motor-driven Stillwell-Bierce triplex pump in the building. A set of Westinghouse low-equivalent lightning arresters for each of the three legs of the transmission line is on one of the side walls of the transformer building with choke coils between the transformers and the arresters. Each wire of the transmission line is also provided with a Westinghouse stick-type circuit-breaker.

The Riverdale plant embraces a dam 500 ft. long on the crest and a brick station building 44x50 ft. in plan, and 24 ft. high inside, built on a concrete sub-structure which is a part of the dam. The site of the station is at a narrow point in the river with solid natural banks on both sides and the dam is made up of a concrete section 154 ft. long, with an earth embankment at each end. The concrete section has a spillway at one end 56 ft. long, with its crest 20 ft. above the bed of the river. The station building is at the other end of the concrete section with a waste way 22 ft. wide between the spillway and the building. This wasteway is provided with three 48-in. openings controlled by circular iron sluice gates which are operated through vertical stands on top the dam, and were made by the Coffin Valve Co.

The site of the dam at the Riverdale plant is at a point where the banks of the river are close together and the earth embankments at the ends of the dam were built up on the natural banks while the concrete section was built across the bed of the stream. Bed rock could not be reached at a reasonable depth, so the dam and the substructure of the power house were carried down 15 ft. below the bed of the stream and built on a torpedo sand bottom. A longitudinal row of railroad rails in 5-ft. lengths were driven 4 ft. into the sand bottom under the spillway and its abutments, 18 in. inside both the upstream and downstream lines of the bottom of the dam and embedded 12 in. in the bottom layer of concrete in the dam. The spillway has a transverse width of 37 ft. at the base and a recess was made in the bottom of it extending 5 ft. above the remainder of the bottom for a width of 17 ft. at the center and the length of the spillway and wasteway. This recess is filled with sand and keys the dam to the bed of the stream.

The bed of the river downstream from the dam was sand and gravel and required special construction to avoid any scouring near the dam due to the water flowing over the spillway or through the waste gates. Three longitudinal rows of railroad rails in 10-ft. lengths were driven flush with the river bed on the downstream side of the dam and heavy stones placed in excavations between the rows. The rails of each row were driven about 1 ft. apart, the rows being 15 ft. on centers and the upstream row 15 ft. from the toe of the dam. The sand and gravel between the rows was removed to a depth of 4 ft. and these excavations filled flush with the top of the apron of the dam and the tops of the rails with heavy boulders.

The Dam and Station Building from the Downstream Side.

The station building is on the downstream side of the dam and its concrete sub-structure is built monolithic with the dam. It is a one-story brick building with a steel truss roof and contains a large machinery room in the main part, with a boiler room adjoining in which the boiler that furnishes steam for heating the station is located. The machinery equipment in this station is practically the same as that in the Somerset station and is in the large machinery room, the arched concrete floor of which rests on the side walls of the building and a transverse concrete pier wall at the center of the building. The water is led from two forebays on the upstream side of the dam through two 10-ft. circular steel flumes built in the concrete of the dam into two steel penstocks in the machinery room. Screen racks are provided in the forebays over the entrance to the flumes and the flow in the flume is controlled by heavy timber sluice gates, operated by rack and pinion gears through stands on the dam wall between the forebays and the power house.

Each penstock in the power house contains a pair of McCormick turbines, with a capacity of 500 h.p., made by the S. Morgan Smith Co. Each pair of turbines is direct-connected to a 250-kw., 2,300-volt, three-phase electric generator made by the National Electric Co. These generators operate at 189 r.p.m., the turbines being controlled by Woodward governors. The available working head on the turbines is 23 ft., but the spillway was built for a head of 20 ft. only to avoid flooding property not acquired by the company when the dam was built. A foot bridge extends across the bridge, however, and arrangements are made for inserting flash boards on the crest of the spillway which will raise the head of water and keep it up during low water in the stream. The mill pond extends 1¾ miles upstream from the dam, with an average width of 300 ft., and permits the storage of considerable water during the day for use at the peak of the load on the plant at night.

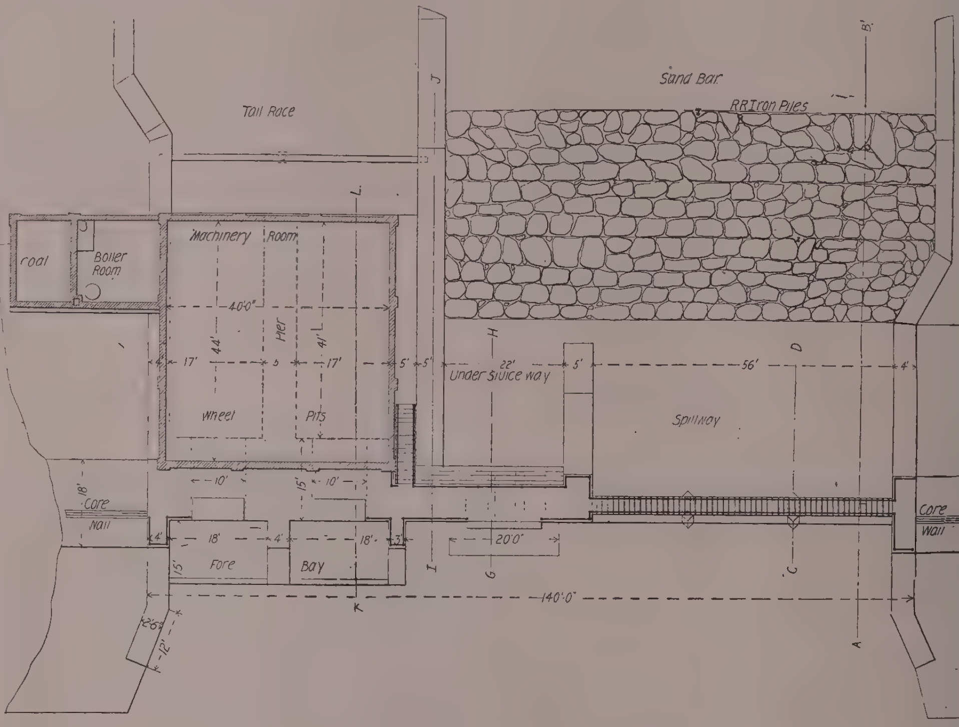
The switchboard equipment is of standard type made by the Westinghouse Electric & Mfg. Co., and is identical with that of the Somerset station. It embraces all the necessary recording instruments for each generator, a voltmeter with a voltmeter switch, a synchroscope and a Tirrell voltage regulator which parallels the exciters of the two units, making the regulation of the plant automatically controlled. Current is generated at 2,300 volts and stepped up to 15,000 volts before being sent to Stillwater. The step-up transformers, lightning arresters and circuit-breaker equipment is the same type, capacity and make as that in the Somerset station, but it is all in the power house.

The earth embankments at each end of the concrete section of the dam have a top width of 12½ ft., with an upstream slope of 1½ to 1 and a downstream slope of 2 to 1. The top of the natural bank on the west side was within 4 to 5 ft. of the required height of the embankment, while a bank 10 to 17½ ft. high had to be built on the east side. A concrete core wall built in connection with the dam extends the length of both embankments and was carried from the top of them to 4 to 6½ ft. below the bed of the stream. This core wall is 2 ft. wide to a height of 5 ft. and is battered on the downstream face from a width of 18 in. at a height of 5 ft. to 6 in. in width at the top. The upstream face of the embankment is riprapped to avoid any danger from wave action.

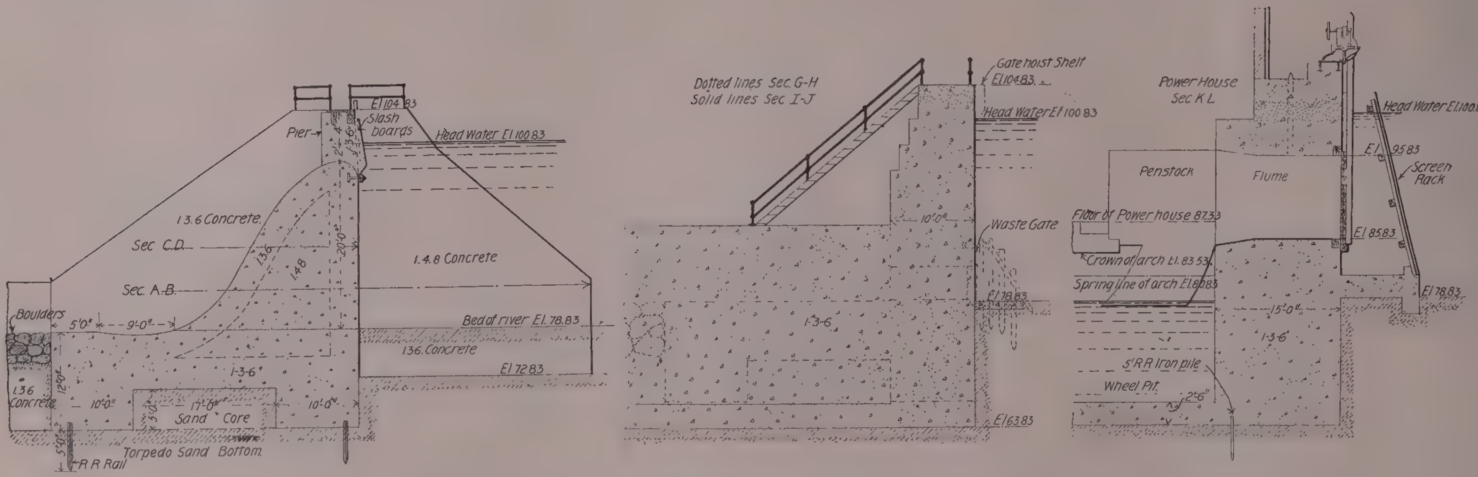
The transmission line leads from the generating station to a sub-station in Stillwater where the current is stepped down from 15,000 to 1,100 volts through three 600-kw., 60-cycle, oil-insulated and water-cooled transformers made by the National Electric Co. The current is delivered to the Stillwater Gas & Electric Light Co., which distributes it through the city. The transmission line is made up of three aluminum strand wires, with a conductive capacity equal to that of a No. 4 copper wire and is strung on Michigan cedar poles. The wires are attached to Locke porcelain insulators tested to 60,000 volts. The insulators are placed in a triangle 40 in. on all sides and are fastened to a ridge iron on top of each pole and the timber cross arm by steel pins with porcelain bases. An underground cable is laid where the line crosses a railroad right of way, but the line is also continued overhead across this right of way to provide uninterrupted service if the cable which is ordinarily in use should be damaged. The line also crosses St. Croix Lake on an 1,800-ft. bridge with a draw in it and a submarine cable at the draw provides for any accident that may occur to the regular overhead line. The transmission line has been in service since July 20, 1904, without any repairs for breaks, and with the exception of one or two instances where the line was put up too taut and had to have a piece spliced in there has been no trouble with it.

The construction of the dam and power house was commenced May 15, 1904, and carried on in the dry, the river being diverted through a temporary channel 50 ft. wide and 1,700 ft. long, at the east end of the dam. The west embankment, the dam and the station building were built in the season of 1904 and the concrete work was finished, the building erected and the water wheels in position when work closed Dec. 2, 1904. Construction was recommenced Apr. 2 last and consisted chiefly in rediverting the river, building the east embankment and installing the machinery, the plant being put in operation July 8 of this year.

After the river had been diverted to the temporary channel the excavations for the dam and power house were made and a hole in the river bed above the dam site filled. Teams and scrapers were used in this work, a trap being built when the work on the embankment was reached and dump wagons used in doing that portion of the grading. The concrete of the dam, core wall and power house was carried up at the same time, special care being taken to avoid breaks or seams in it. The excavations for the immediate site of the concrete had to be carried down in timber casings to keep the sand out of them. These casings were built on the surface in 6x12-ft. sections with four sides and lowered as the excavation was carried down. The slack water from a dam downstream caused some supage into the foundation excavations and required the operation of three 8-in. centrifugal pumps, made by the Morris Machine Works, to keep the water down, one of the pumps being operated by steam and the other two by electric motors with power from the Somerset station.



Plan of the Dam and Station Building.



Cross-Sections of Dam through Spillway, Waste Gate and Station Building.

The concrete was all mixed wet in a Smith mixer operated by an electric motor, hauled to place in wheelbarrows and dumped from temporary runways. The concrete in all portions of the work above high water mark and where there is little pressure on it was mixed in the portions of 1 part of cement, 4 parts sand and 8 parts broken stone. The remainder was mixed in portions of 1 part cement, 3 parts sand and 6 parts broken stone, 4,500 cu. yd. of the latter mixture being used and about 500 cu. yd, of the former. Owl Portland cement, clean river sand and the crusher run of broken stone, with pieces larger than 1½ in. screened out, were used in the concrete. The stone was mostly glacial drift boulders from the river bed and adjoining land, which were crushed in a Gates crusher operated by an electric motor.

The millpond was filled for the first time May 17, 1905, and a small leak developed on the downstream face of the west embankment just inside the abutment of the dam. A portion of the embankment there had been built entirely outside of the line of the naural bank and to avoid any liability of a failure at this point the water was drawn down and concrete filled in the weak spot. A flood of unusual height began June 6, following and continued for 10 days without any indication of damage to the embankment or leakage, the clay and gravel soil of which the embankments are built and the filling made with that material above the dam having apparently also shut off any seepage. The protection of boulders below the dam has effectually prevented any scouring of the stream bed.

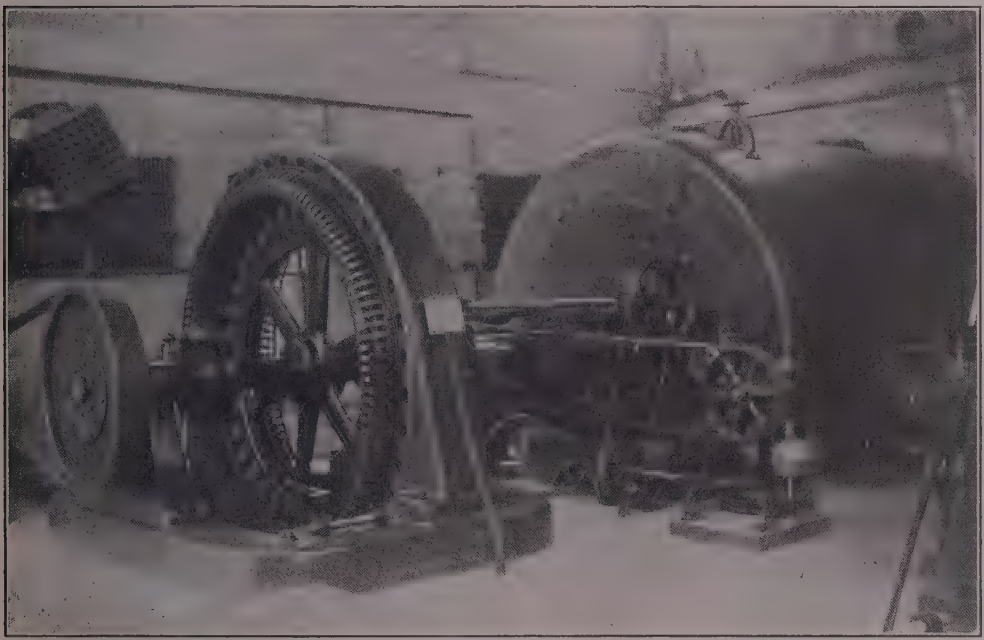
The Riverdale station and dam was designed by Mr. R. S. Feurtado, chief engineer of the Western Gas & Investment Co., of Chicago, and the construction work was carried on under his immediate direction. The remodeling of the Somerset station was also done under Mr. Fuertado's supervision.

The Relation of the Engineer to the Architect.

The development of architecture has reached such a stage that not only does it demand a high order of engineering ability for the solution of structural problems but requires special information in mechanical engineering to design satisfactorily the machinery and steam plant for buildings of only moderate size according to modern views. At the last annual convention of the American Institute of Architects this subject was brought up in an interesting paper by Mr. C. T. Purdy, M. Am. Soc. C. E., on the relation of the engineer to the architect under the conditions that have lately developed.

Structural and mechanical problems in building work, he pointed out, were comparatively few in number preceding the advent of rolled beams, while accurate and definite methods of treating such problems were relatively crude and unsatisfactory, and electrical problems were entirely unknown. In these days such problems fairly burden every design, and they are susceptible of definite calculation and accurate determination. Except from this point of view, it is scarcely possible to appreciate what an evolution is going on at the present time in the relation of the architect to his work and in the operations of his office or to realize that these changing processes are not yet completed. Mr. Purdy confidently predicted that any practice by the architectural profession which fails to appreciate the rapid development of the engineering profession as a whole will ultimately come to naught.

Ten years ago, when Mr. Purdy moved his office to New York, he was told that there was no chance for an engineer in that city; that excepting a few who regularly employed engineers in their office force, the architects depended upon one of three or four of the great iron manufacturers of New York for their steel designing, and that that arrangement was a fixed one in the architectural practice of the city. He was told that the custom was so thoroughly established that it could not be disturbed. The office was, nevertheless, started in the belief that such a custom would go to pieces of its own accord. In a very large degree this has already happened, and he believed it was a fair illustration of what will eventually happen to every relation between men that is not reasonably considerate of all interests concerned.



One of the Penstocks and 250-kw. Generators, Riverdale Plant.

The structural engineer ordinarily includes in his part of the work the structural frame-work of the building, be it much or little, the foundations, and also the masonry whenever it becomes complicated or questions of strength are involved. This part of the designing of a building can be accomplished in several different ways. 1, The architect may do the work himself without assistance. 2, The architect may have the work done by some manufacturer. 3, The architect may have the work done by the builder, or the owner, with his consent, may have it done in that way. 4, The architect may employ the engineer as a part of his own force. 5, The architect may associate the engineer with himself as a partner. 6, The architect may employ a consulting engineer, who has his own independent office and practice. 7, The architect may be associated with such an engineer, employed directly by the owner, without any personal arrangement with him in relation to the matter. 8, The engineer may have control of all the work, with the architect more or less subordinated to him. All of these methods of getting the work done are in vogue at the present time. It is a wide divergence of practice and certainly a very undesirable condition of affairs. With engineers in other departments, particularly in electrical work and heating and ventilating, the practice is more uniform, but not sufficiently so. This wide divergence of action has, first of all, grown out of the varying conditions among the architects themselves. Some have technical training, and their best work pertains to the structural part of their problems, while others, and among them some of the best designers, have little or no taste for construction. To some extent, this difference in practice has grown out of a fear of trusting to outside help. Some architects have been willing to try it, while others have not. The divergence of practice is also due to a failure to appreciate good work. The great structures of our cities vary in strength and stability, and in every other structural characteristic from the wretchedly poor to the wastefully good. There remains, however, another explanation of this divergence, a more important one perhaps than all the others put together, and that is the cost.

The steel frames in some of the most notable buildings, both of the East and the West, have been designed by the builder or under his immediate direction. This is particularly true of some of the first high buildings. The builder's confidence in the practicability of the new methods of construction, and his willingness to share in the responsibility of their introduction, made that way of doing the work acceptable and pardonable when these first buildings were erected. It is an undesirable relation, from the architect's point of view, and that is sufficient to prevent its general adoption.

The employment of engineers by an architect as a part of his own force is also open to at least two serious objections, particularly when it is done in an office of moderate size. The character of the work which is ordinarily produced under such circumstances is not likely to be of a high order. The other objection comes from the other point of view. The subordinate and limited character of the service ordinarily required in such cases is certain to be distasteful and not acceptable to the most competent engineers. For these two reasons it is a method that probably will not be permanently maintained. The structural and mechanical problems in any office, be it large or small, are likely at any time to require the services of men whose training and ability will compare favorably with that of the architect himself, or to put it another way, these problems may at any time become the most important problems connected with the architect's business. Moreover, all men are prone to work in ruts and to repeat their faults. If an architect is constantly dependent upon one or two men in his own office, there is no getting out of these ruts or escaping from these faults, unless it be by occasionally changing the method of having the work done, or by changing the employees themselves. One of the leading engineers of the country, in speaking of this matter recently, said: "I have had occasion to note several times the limited scope of the knowledge and experience of the technical assistants employed on salary by the architects and contractors."

The employment of the engineer by the owner as the associate of the architect or in general charge of the work is also undesirable; as an associate it divides responsibility, in charge of the work it subordinates all other considerations to the structural. Eventually it would be humiliating to the architect. It does not conserve the best interests of either the owner or the architect. Both arrangements are a mistake, and neither can attain a general acceptance, in or out of professional circles.

On the other hand, consideration of such a plan cannot be turned away lightly. If some solution of this difficulty is not found, if some systematic effort is not made to "standardize" this relation, if such an expression may be used, the engineer will strive to push himself forward in just such ways as these, and will meet with encouragement from the public.

Objections are also repeatedly made to the employment of a consulting engineer. It is urged that the dividing of the work is a disadvantage to the architect, and that it obstructs and delays the men employed in the architect's office on other features of the design. The desire to keep the work under personal control is usually due to this notion; but sometimes it is due to a feeling of satisfaction in doing everything one's self, and occasionally it is born of the wish to monopolize the credit of every achievement with which one has to do. These ideas and desires are not only in the larger offices, where the volume of business is sufficient to warrant their gratification, but architects having smaller practices are governed by the same ideas. A much greater difficulty, however, is the question of compensation, to which reference has already been made. The expenditure of so large a part of the architect's commission in one sum always seems a hard thing to do.

The dividing of the work in the architect's office and the likelihood of delay growing out of doing so seem tangible enough to those who have believed it, and who have had little or no experience to disprove the notion. The dividing of the work is more likely to give point and snap to the work remaining to be done in the architect's office, than otherwise. No consulting engineer can preserve his independence in business unless he can find a way of doing his work with little or no trouble to his client and also unless he can do it quickly, making every figure and every line count in the final result. He cannot afford to have the work drag in his office, nor to speculate with uncertain data. The engineer objects to doing work until things are settled. So decisions are hastened, and both the architect and the engineer get the benefit.

The cost of the work, as already stated, has been the hardest difficulty to satisfactorily adjust. It has prevented the employment of the engineer more than anything else. If the cost of his services could always be obtained from the owner without encroachment upon the architect's regular fees, it would undoubtedly do much to simplify the problem. But the general acceptance of such an arrangement in the immediate future can hardly be hoped for. It is probably a fact that the amount of work required of the architect in these days, in proportion to his income, is greater than it used to be, and that this additional compensation, if it may be called such, would not make the architect much, if any, better off, than he would have been with the same amount of work a few years ago. It is also true that some owners have already paid this additional compensation, and that some others can be easily induced to pay it; yet, notwithstanding these points to the contrary, it is important that the success of the movement should not be dependent upon the willingness of the public to pay the extra commission.

In the opinion of Mr. Purdy, the engineer's commission should be paid by the architect, and should be adequate. An extra commission on account of this expense should be obtained from the owner, if possible. The compensation should be a commission. If an extra commission can be obtained from the owner, the engineer should get the benefit of it. If the extra compensation cannot be obtained from the owner, the engineer should be content with a smaller commission. The commission should be the same for all kinds of engineering pertaining to building work, structural as well as mechanical; and the commission should cover only the work included in the service.

The engineer's compensation should be paid by the architect, because that is most in keeping with the subordinate relation of the engineer. It puts into the architect's hand without friction and without question the power to retain his management of the business.

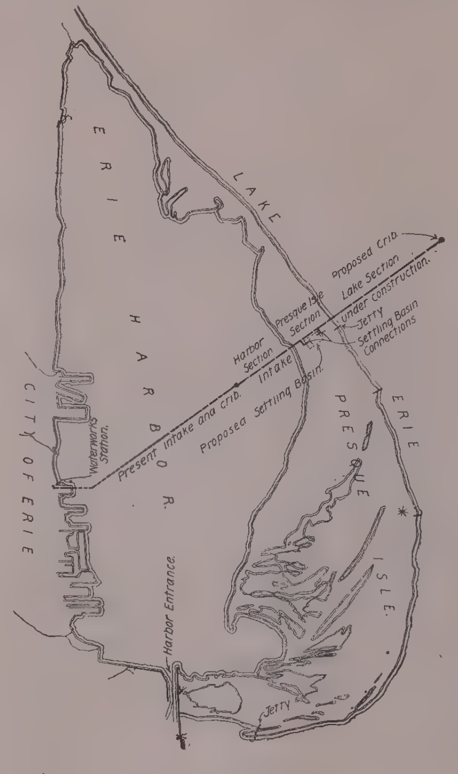
If an additional commission is paid by the owner, the engineer should give something for it, otherwise it will be difficult to persuade the owner that the additional compensation is necessary. It is suggested that the engineer should assume the full responsibility of the architect in reference to his part of the work when he receives the full commission, that is, the full compensation which he should receive when an additional commission is obtained from the owner; and on the contrary, that he should not be held any more responsible than an employee of the architect's office, if this full compensation is not paid. This will be to the advantage of both the architect and the owner. It will tend to prevent the employment of incompetent men as consulting engineers, it will encourage the employment of better employees in the engineer's office, and will promote better work in every way.

In order to give point to this suggestion with reference to compensation, Mr. Purdy suggested the following rule to cover all ordinary work: Charge the owner 7½ per cent. commission for all technical work for which engineers are required. If the 7½ per cent. is obtained from the owner, pay the engineer 5 per cent. when superintendence is included in his services and 3½ per cent. when it is not. If only 5 per cent. commission is obtained from the owner, pay the engineer 3½ per cent. when superintendence is included in his services and 2½ per cent, when it is not. The cost of the engineer's services for extraordinary work under this rule would have to be adjusted in each individual case, and the question of whether work was ordinary or not would have to be determined before the work was begun. The rates named in the rule would not be sufficient to cover all cases. Often the actual cost of designing the structural steel work for a theatre, without superintendence, is 5 per cent. or more.

There are perhaps twenty-five or more engineers of large experience in the several departments of building construction, now in independent practice in different parts of the United States, and the most eminent and the most capable men in the world in these departments of work are to be found in this number. The moneyed interests of the country are awakening to a greater conception of the importance of good structural and mechanical designing, and more and more, in the future, they are going to require technical services of a high order. They will eventually force the situation. Unless some arrangement is made for co-operation, most of these engineers will, sooner or later, be employed by the interests that now employ the architects, and the more this is done the more difficult it is going to be to standardize the relation of architect and engineer.

The New Intake of the Erie Water Works.

The water supply of Erie, Pa., is drawn from Erie Harbor, an arm of Lake Erie, through a 5-ft. cast-iron intake pipe, 8,307 ft. long, connecting a submerged intake crib with the pumping station of the water works on the shore of the harbor. The harbor is to be abandoned as a source of supply and a supply drawn from Lake Erie by building an extension to the present intake. Erie Harbor is a bay, 4¾ miles long, and with an area of 5½ sq. miles, which is formed as shown in the accompanying illustration, by a low bar of sand called Presque Isle. The water is from 20 to 26 ft. deep on 2 sq. miles of the harbor at the middle, with decreasing depths toward the shores, especially toward the outer shore where the depth over considerable areas is less than 5 ft. The harbor is practically landlocked, however, except at the entrance through which the water flows in and out as the level of the lake rises and falls from the action of the wind, or other causes, the difference between high and low water levels being as great as 5 ft. The city is built along the inner shore of the harbor and discharges its sewage directly into the harbor without any attempt toward purification. The original intake of the water works was built in 1868 and is a combination of brick, wood, and boiler-iron conduits, with a total length of 975 ft. The water of the harbor became so polluted in the vicinity of this intake that the present cast-iron intake, extending to within 1,500 ft. of the outer limits of deep water in the harbor, was laid. This conduit was completed and put in service in 1896 and the original intake abandoned.



Map of Erie Harbor.

The discharge from the municipal sewers and the wastes from extensive manufacturing plants in Erie have gradually polluted the water of the harbor until, in some places, it is particularly offensive and the water of the entire harbor is more or less polluted at all times. Several small streams which flow into the harbor are also polluted with a considerable amount of sewage. The water of the harbor has thus become entirely unsatisfactory as a supply and a 5-ft. riveted steel pipe extension, 9,930 ft. long, is being built to the present 5-ft. cast-iron pipe intake, making the total length of the intake conduit 18,237 ft.

The extension is to be carried from the submerged intake crib at the end of the 5-ft. cast-iron intake on across the harbor and the peninsula, and thence 5,430 ft. in the lake to a submerged intake crib that is to be located at that point. The lake water at the site of the new crib is practically free from pollution, and is satisfactory for a supply, with the exception of a considerable turbidity at certain seasons of the year due to the action of waves in the shallow water near the shore line. It is proposed to build settling basins on the peninsula which will be of sufficient capacity to remove the greater part of the sediment, and the Commissioners of Water Works control enough space on both sides of the pipe line for a filter plant, should such a plant ever be required. A filter plant could have been erected on the harbor shore and the supply from the present intake retained, but the harbor is becoming polluted so rapidly that an extension to procure the lake water would have had to be undertaken eventually at any rate.

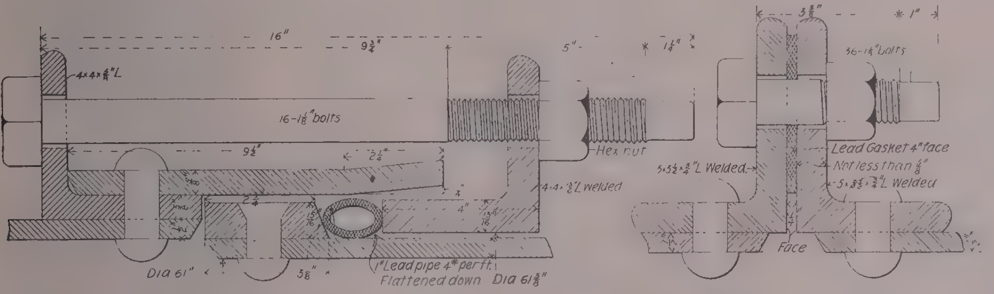
The extension is made up of three sections. The first section is 2,795 ft. long and extends from the present intake crib in the harbor to the shore line of the peninsula. The second is 1,705 ft. long, and extends across the peninsula. The third is 5,430 ft. long, and extends from the shore line of the peninsula on the lake side to the intake in the lake. The first section has been finished, the second section is about half completed and work is in progress on it and on the third section.

The same thickness and quality of steel is being used in the pipe throughout and practically the same methods of laying have been followed in the work that has been completed. The pipe is built up of ½-in. soft-steel plates, which are required to undergo successfully the standard tests for boiler plate. The plates are rolled in the Homestead works of the Carnegie Steel Co., and the pipe is built in the plant of James McNeil & Bro. Co., Pittsburg, Pa. The pipe is coated at the shop with mineral rubber asphalt pipe coating, which is required to show no tendency to flow at 130° Fahr., nor to become so brittle as to scale at zero Fahr. The pipe is made in 30-ft. lengths, except specials, and these lengths are heated to a temperature of 300° Fahr. immediately before coating, and then dipped vertically in a bath of the coating. All field riveting and all joints between the lengths which are made on land at Erie, are carefully painted with Smith's durable metal coating.

The pipe is constructed with taper rings or courses, the small end of each ring being inserted in the next adjacent ring. Each course has but one longitudinal joint, which is a double-riveted lap joint, while the circular joints are single-riveted lap joints. The pipe is shipped from the shop to Erie in the 30-ft. lengths in which it is made, and the lengths are riveted in 120 or 150-ft. sections on land after they have been unloaded at Erie. The pipe is laid in these 120 or 150-ft. sections, except in special cases, and the joints between the sections made under water by a diver.

The ends of the lengths of pipe forming the ends of the sections have a special submarine joint, shown in detail in an accompanying illustration, except at connections to specials, where faced welded steel angle flanges are riveted to the pipe. This joint is a slip-sleeve joint formed by a circular plate and an angle on the end of one section and a loose angle and a circular lug riveted on the adjoining end of the next section. One angle is shop riveted on the end of a section, and the circular plate riveted on outside of that, forming a sleeve extending beyond the end of the section. The attached angle is fitted with 16 bolts extending longitudinally with the pipe about 6½ in. beyond the outer end of the circular sleeve plate. These bolts are threaded at the outer end and carry the second circular angle, which is free from both sections and from the bolts. The end of the other section to which the lug is riveted slips into the end of the section carrying the sleeve plate, the edges of the lug on the one section and of one leg of the attached angle on the other section abutting. The horizontal leg of the loose angle follows into the sleeve after the lug, and the space between the end of it and the lug is filled with a 1-in. lead pipe. The lead pipe is flattened down before the joint is made, and then as the sections are drawn together by tightening the bolts, the lead pipe takes the shape of the opening in the joint and calks it.

Several expansion joints have also been placed in the line. These joints are made by inserting between two regular land joints a short length of pipe with an angle attached to one end and the other end smooth. The end carrying the angle is joined to the end of a regular length by a standard land joint, but the smooth end is slipped into the end of another regular length of pipe until it laps 2½ to 3 ft., the space between the two pipes in the joint being 3/16 in. The leg of a loose circular angle around the short expansion joint length of pipe is then bolted to the vertical leg of the angle riveted to the end of the regular length of pipe, the horizontal legs of the two angles extending in opposite directions in the same plane. Bevels are cut on the abutting corners between the angles so as to form with the outside of the inner pipe an annular space, irregularly triangular in cross section, in which a ⅝-in. lead pipe is placed. The loose angle is drawn as close to the attached angle as possible with the bolts, thus squeezing the lead pipe until it takes the shape of the annular space and makes a tight joint.



Detail of Submarine Joint and of Joint for Special Connections.

The old intake pipe is laid in a trench in the bottom of the harbor and covered with varying depths of material removed from the trench. The new intake pipe will be laid in the same manner and also covered with material from the trench. The depth of the trench varies from 8 to 21 ft. below the surface of the ground and the depth of water in which the excavation has to be carried on varies from work in the dry on two short lengths on the peninsula where the ground is several feet above the water line to a depth of 44 ft. that will have to be reached in locating the intake crib in the lake. The material that has been handled is mostly fine lake sand, although nearly a third of the trench in the harbor section was made in the mud.

The first work was started at the present intake crib, which is an octagonal timber structure 40 ft. in its extreme width and 8½ ft. high, the top being 13 ft. below zero level of the harbor. The 5-ft. cast-iron pipe is 32-ft. below the zero harbor level at the crib, and is connected with one end of the cross of a T connection in the crib, the stem of the connection extending up into the crib, while the other end of the cross was blanked. A small dipper dredge was first put at work on the trench next to the crib and pipe laying carried toward the peninsula. The material encountered was very soft and ran so badly it was almost impossible to cast it, so progress was slow until a larger dipper dredge was procured. Even then the character of the material interfered greatly with the work, the slopes on the sides of the trenches in the harbor becoming as great as 4½ to 1. A 20-in. centrifugal dredge was finally put in operation digging the trench, and since then the work has been proceeding much more rapidly.

The steel pipe is delivered on a dock at the water front in Erie, which is about 1¾ miles from the present intake, and the 30-ft. lengths are riveted in 120 and 150-ft. sections at the point of delivery. When sufficient length of trench to accommodate a section of pipe has been opened the ends of a section on the dock are sealed with bulkheads fitted with air locks and the section launched into the water from ways, about half of the total length of the pipe having already been launched in this manner without accident. A tow line is attached to one end of the section, and as soon as the section strikes the water a 20-h.-p. gasoline launch starts toward open water with it. The sections float more than half out of the water and are easily towed into position over the trench.

The bulkhead on the blank end of the cross of the T connection in the crib was first removed and a section of the steel pipe connected to it, and then the end of steel pipe section was blanked. When the trench had been opened for the next section four piles were driven at each end of this portion of the trench immediately over the site the ends of the section were to occupy, two piles on each side of both ends. The piles were then thoroughly cross-braced and capped with a heavy timber to each transverse pair of piles, then another heavy timber was placed over the two caps on the four piles at each end of the section and at right angles with the lower caps. The section of pipe was then towed into place with its ends between the pile bents and swung by ropes attached at each end to a block and tackle on the caps of the bents. These tackles have 3 sheaves, making 7 strands of 2-in. rope and with the ends of the ropes hitched around the pile caps one man could control the movement of each end of the section of pipe. The air locks in the bulkheads on the ends of the section were then opened slightly, and as the section filled with water it was gradually submerged by playing out the rope through the blocks. A line was hitched around the section near the middle and carried to the pair of bents over the end away from the joint, and as the section lowered it was held away from the adjoining section already laid, so the diver could have plenty of room to make the submarine joint.

This same method of laying has been carried on in all the work that is finished, and it is believed it can be continued in the lake work. The piles are driven by one or both of two floating pile-driver boats, fitted with Lidgerwood hoisting engines, one of the boats carrying a pair of 15-ton shear legs. One of the pile-driver boats is stationed at the end where the joint is to be made, and the diver's boat is, of course, also at that end. When the section is lowered into position the diver goes down and removes the bulkhead from the end of the pipe that has already been laid and the one from the adjoining end of the section just lowered. The section is then drawn into place with the assistance of a hoisting engine on the pile driver boat and the bolts in the joint placed by the diver, and tightened from the surface, a rachet wrench being used in tightening the bolts. The diver places the wrench on the nut of a bolt, then the wrench is manipulated with a rope by men on a platform on the piles overhead, each nut being screwed on a few turns at a time to bring the joint squarely together. A 1-in. wire cable sling is put around each end of the section before the ropes and tackles are removed and the ends of the cables fastened to one of the caps on the pile belts at each end of the section. The cable fastenings on the pile caps are 1½-in. eyebolts placed vertically through the cap and threaded at the upper end. The connection between the eye of the bolt and an eye in the end of the cable in each case is made by a shackle, the whole arrangement permitting accurate work in leveling the section of pipe by nuts on the upper end of the eye-bolts. When the cables are in place the two extra piles at the end where the joint was made are removed and the trench backfilled by the dredge. The piles at the other end are left, though, and the section suspended until the joint with the next section has been made.

When the pipe laying reached the peninsula the dredge continued about half way through to the lake carrying the trench to grade. To permit the dredge to take advantage of the quiet season on the lake the dredging was discontinued when the work had gone thus far and the dredge started at work on the site of the new intake crib in the lake. When the crib is in place pipe laying will be commenced on the lake section. The lake section will be laid from the crib toward the peninsula and then in the peninsula to connect near the lake with the pipe already laid. The trench on the land side of the peninsula will be closed, however, before the dredge reaches it from the lake side.

The site of the first proposed settling basin is at one side of the line near the middle of the peninsula and two branch connections to the pipe line, each 130 ft. long, are being made on that side, about 680 ft. apart, to provide for this basin or other works that may be located there. Five 60-in. gate valves are to be located on the peninsula to control the flow through these connections and the pipe line. Three of the valves are placed on the pipe line, one on the lake side and one on the land side of the connections, with the third one between them, the connections being each provided with a valve.

The soil of the peninsula is practically all fine lake sand in which there are a few depressions filled with matted vegetable growths and water. The water level is at, or very close to the ground line in the vicinity of the sites of the valves, so the construction of masonry valve chambers surrounding the valves would have been very difficult and specially designed timber wells have been built instead of masonry structures. Each well is 7 ft. 8 in. by 11 ft. 4 in. in plan and 17 ft. deep, with its ends, sides and bottom built entirely of 8x8-in. timbers, and with an 8x8-in. post in each corner, and the joints between the timbers at the corners alternately overlapping. The joints were thoroughly calked and then the whole well was sheathed with ⅞-in. tongue-and-grooved maple flooring.

The wells were built on a dock near the point where the pipe was delivered, and then loaded on scows and carried to the peninsula. Short steel thimbles, 5 ft. in diameter, were placed in each side of each well as the timbers were brought up and space left between the ends of the thimbles on the inside of the well for the valve. The outer ends of the thimbles are flanged to connect with the adjoining ends of the pipe line, while the inner ends fit into hubs on the valve. A loose circular angle is fitted closely around the thimble inside the well with its horizontal leg extending into the joint between the timbers of the well and the thimble. When the valve is in place blocks are wedged between the loose angles and the flanges of the hubs of the valves, forcing the loose angles into the joint in the side of the well and holding the valve in position. The weight of the valve rests on two 6x12-in. timbers on the bottom of the well. Special lugs, square at the bottom, are cast on the lower part of the flange of the valve hubs and rest on other timbers on the bottom of the well, serving more to steady the valves than to support them.

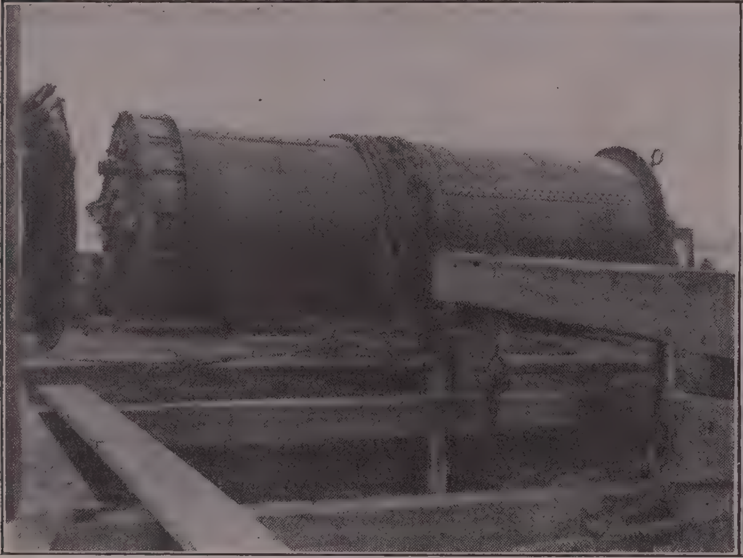
The valves are cast-iron and bronze mounted, with double taper seats, solid discs and rising stems. They were built by the Coffin Valve Co., of Boston, Mass. The stems are of bronze 4 in. in diameter from the gate to the mean lake level, with the upper portion of the stem of steel. The valves are opened by hand through horizontal ball-bearing operating stands on a floor over the gate well, the bearings of the gearing on the stands floating in oil.

The wells were dumped from the scows in shallow water near their sites on the peninsula, and left there until the valves were set in position. The site of a well is excavated by the dredge and then the two pile-driver boats tow the well to place and lower it in position. A wire-cable sling attached to lugs on the gate valve is then fastened to a pile bent over the site, much the same as the sections of pipe are swung, and when the valve and well are accurately in place backfilling is placed around it and the swing removed.

The timber intake crib is 40 ft. square, 19 ft. high, with a flat top and bottom and vertical sides and its top will be submerged 25 ft. when it is in position. Its four sides are built of 12x12-in. hemlock timbers with two transverse vertical rows of 12x12-in. timbers and two longitudinal vertical rows of 12x12-in. timbers, dividing the crib in 9 sections, or pockets, each 12 ft. square, in three rows. A layer of 4-in. planks is laid over and spiked to the bottom layer of timbers and a layer of 3-in. plank laid over the 4-in. plank and spiked to them. The first layer of plank is laid diagonally with the crib and breaks joints on the transverse vertical rows of timbers. The 3-in. planks are laid in the oposite diagonal direction and break joints on the longitudinal rows of timbers. A 6-in. space is made between each horizontal layer of timbers in the sides and cross rows by mortising the 12-in. timbers 1½ in. on the top and bottom at the joints. The intake pipe extends through the crib on the bottom of the middle transverse row of pockets and is blanked at the outer end. A vertical connection 6 ft. long extends up from the pipe in the center pocket and is open at the top. The four corner pockets will be filled with rock to hold the crib on the bottom. The two inner sides of these pockets will be lined with vertical 3x12-in. plank with a 2-in. notch cut in both sides of the plank from the top to a depth of 4 ft. The other 5 pockets in the center longitudinal and transverse rows are covered with wooden gratings. The crib is thoroughly cross-braced by the cross rows of timbers and the timbers are all spiked and drift-bolted together.

The crib was built on a dock on the water front and launched into the water. It was then towed to a point near the land side of the peninsula and anchored there in shallow water pending the excavation of its site in the lake. When this excavation is completed the crib will be towed out through the harbor entrance to the site and sunk by filling the corner pockets with stone. The excavation will then be backfilled and a rip-rap protection of rock laid around the four sides.

The extension is being built by the Commissioners of Water Works in the city of Erie, of which Mr. Clark Olds, Asso. Mem. Am. Soc. C. E., is president, and Messrs. G. F. Brevillier and Willis B. Durlin are the other commissioners. The preliminary work was carried on by Mr. Geo. H. Fenkell, Asso. Mem. Am. Soc. C. E., civil engineer to the commissioners, who also laid out and designed the pipe line and its various structures and is directing the construction work. Mr. E. J. Morton is Mr. Fenkell's assistant. The general contract for furnishing the pipe and building the extension was awarded to the T. A. Gillespie Co., of Pittsburg, and is being carried on under the supervision of its engineer, Mr. Frank Wilcox, Mem. Am. Soc. C. E. Mr. Elmer Williamson is immediately in charge for the contractor. The dredging is being done by the Lake Superior Contracting & Dredging Co. Mr. J. A. Evans, of the Erie Laboratory, inspected the steel and pipe at the mill and shop.



A Special Section Ready for Lowering, Showing Bulkhead.

Timber Valve Wells under Construction on the Shore.

The Manufacture and Properties of Hollow Concrete Blocks.

The general interest in hollow concrete blocks as an important building material is so great that Prof. S. B. Newberry has made a careful study of their manufacture and properties. At the Atlantic City meeting of the Association of American Portland Cement Manufacturers he read a paper on concrete block construction in which some of the results of his investigation were summarized. With regard to materials, he thought there was little choice between sand and gravel and stone screenings, if of good quality. Sand and gravel are generally cheaper and somewhat easier to mix perfectly with the cement. There appears to be no difference in the strength and hardness of the blocks made with the two aggregates, for the strength depends on the density of the mixture, which is chiefly a question of the voids. It is well known that a mixture of cement and sand is weaker than the same mixture with the addition of coarse gravel. For example a 1:3 mortar will have a lower strength than a 1:3:4 concrete, although the latter contains only half as much cement as the former. Some experiments with two samples of gravel illustrate this clearly. Gravel A was a mixture of sand and fine pebbles; it weighed 127.5 lb. per cubic foot and had 22.9 per cent. of voids. Gravel B was composed of pebbles of nut to egg size; it weighed only 100.9 lb. per cubic foot and had 38.9 per cent. of voids. A mixture of equal parts of A and B weighed 139.6 lb. and had but 15.5 per cent. of voids. A 1:6 concrete using a mixture of A and B would have been as strong as a 1:3½ concrete with gravel A alone.

A good indication of the value of gravel or stone screenings for concrete may be obtained by filling a cubic foot box with the material and weighing it. A solid block of 1 cu. ft. of limestone or quartz, free from voids, will weigh about 165 lb. The amount by which a cubic foot of gravel or stone falls short of this weight represents roughly the proportion of voids, or empty spaces, contained in it. For example, if a cubic foot of gravel weighs 130 lb., the voids would be 21.2 per cent. of the total volume. A few trials will show that for best results the mixture must contain a large proportion of coarse material. Very few gravels will be found that are not improved by the addition of pebbles, and the greatest strength is obtained with material that contains comparatively little sand.

There is, however, another consideration which enters into the selection of materials for block concrete, and that is the appearance of the surface of the work. Unless a facing is used, a fair amount of fine material must be present to give the blocks an even surface. Nevertheless, it will be found that much coarser gravel or screenings may be used, with good results, than is generally supposed, and that the appearance of the work is not injured by the addition of a large proportion of coarse pebbles, up to about ¾ in., while the strength and density are greatly improved by this addition. A 1:5 mixture of cement and gravel, containing at least 50 per cent. of pebbles remaining on a ⅛-in. screen, will be found better than a 1:3 mixture of cement and sand only.

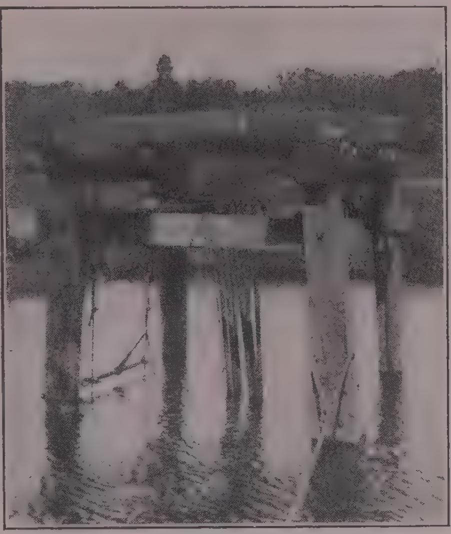
As to the character of the sand and gravel to be used, there are many tests on record, Prof. Newberry stated, which show that rounded grains give greater density and strength than sharp irregular splinters, and that a small percentage of loam or clay does no harm provided the mixing with cement is thoroughly done.

Another material which may be used with advantage in block concrete is slaked lime. In poor mixtures, as 1:4 and 1:5, the addition of lime improves the strength and lessens penetration of water; it also makes the blocks whiter on drying. It is possible, also, to replace part of the cement used, perhaps one-third, by slaked lime, without loss of strength. The most convenient form of lime for block-makers' use is the dry-slaked or hydrated lime, now a common article of commerce. At present prices, hydrated lime costs almost as much as Portland cement, and there is no great saving in using it. However, it forms a simple means of improving the appearance and water-resisting qualities of the work, and a few experiments will convince most block-makers that it is a valuable addition to the mixture.

The proportion of cement to be used will depend on the strength, appearance and impermeability desired. So far as strength is concerned, very poor mixtures, as 1:7 or 1:8, may answer every requirement. Blocks made from such poor mixtures, however, absorb water like a sponge, and will not answer for the walls of dwellings, though they may perhaps be good enough for partitions, retaining walls, and buildings in which dampness is no objection. For dwellings, a poorer mixture than 1:5 is not to be recommended. Much depends, of course, on the character of the gravel or screenings employed. With properly graded gravel or screenings containing a large proportion of coarse material, a 1:5 mixture will be found better than 1:3 with cement and sand only. Prof. Newberry recommended a mixture composed by measure of cement 1, hydrate lime ½, sand and gravel 6. This is practically a 1:4 mixture, with fair water-proof qualities, sufficient at least for dwellings which are to be furred and lathed. If plastering is to be applied directly to the inside surface of the walls, it is necessary that the blocks shall absorb water only very slowly, so as to be only partially penetrated during a long-continued rain. Such a result can be reached by giving the blocks a facing of richer material, perhaps 1:2, or by using a sufficiently rich mixture for the whole body of the blocks such as cement 1½, hydrate lime ½, sand and gravel 5, or cement 1, hydrate lime 1, sand and gravel 5. These should be effective with gravel or screenings of suitable character.

The use of a proper amount of water is essential to good work, and in this respect many block-makers are extremely careless. It is well known that a fairly wet concrete is far better than a dry one, and that too much water is better than too little. A rather dry mixture may be more convenient to use, and may enable the maker to turn out a larger number of blocks in a day, but the resulting work will always be porous, weak and crumbling. On the other hand, the extravagant claims made for the wet process, in which the concrete is poured into the molds and left for many hours to harden, are, according to Prof. Newberry's experience, chiefly imaginary. It is perfectly practicable to produce concrete of the highest possible quality and still to remove the blocks at once from the molds. The mixture must be as wet as it can be made without sticking to the plates, and without sagging or becoming distorted when taken from the machine. Blocks so made will be found at least equal in strength and hardness to any that can be made by pouring. They are also much more attractive in appearance, showing a rich, sand-stone-like surface, instead of the dull, lifeless look which the wet process gives. As compared with blocks made from too dry a mixture, they are lighter in color, denser, stronger and more impermeable.

The correct percentage of water varies with the materials, but is generally from 8 to 9 per cent. of the mixture by weight. It will be found that a mixture containing much coarse gravel or stone may be made much wetter, without sagging or sticking, than one of finer material.



Pile Bents over a Submarine Joint, New Intake of Erie Water Works.

The materials, carefully measured, should be thoroughly mixed dry, then the proper amount of water added and the mixing continued. Thoroughness in this part of the operation will be found to pay for itself many times in improved work. Uneven color of blocks results from imperfect mixing, and especially from varying the proportion of water. The use of a good concrete mixer is far preferable to mixing by hand, both in saving of time and labor and in thoroughness of work done. Hand mixing, by the use of a hoe, must be vigorous and long-continued, or the full effect of the cement used will not be obtained. The inferior work of many small-scale block makers is largely due to this cause.

Block machines may be generally divided into two groups: those with horizontal and with vertical cores. The former are usually considered the more convenient for making faced blocks, though a facing can be put on with either type of machine. The use of a facing of finer, richer or colored mixture must be called a matter of taste. In the judgment of Prof. Newberry it does not pay to use a facing, as the additional labor and preparation of a separate mixture cost more than to make the whole block of suitable composition to give a good surface. If the facing differs much from the body in composition, also, it is likely not to adhere perfectly, and trouble has been experienced from this cause. However, for water-proof and colored work a facing may be found an advantage, and doubtless many will give preference to a machine which allows this to be conveniently applied.

Machines are provided with face-plates for the production of rock-faced, tool-faced and plain blocks, and various ornamental designs, for borders and friezes, are also furnished. Plates for rock-faced blocks should always be cast from a natural stone, and several different patterns of each size should be obtained, to avoid monotony in appearance of the work. Many machines are provided with rock-face plates evidently cast from some molded soft material, which yield blocks with a surface more like that of pats of butter than natural stone. Such makeshifts are abominable, and a fraud on the purchaser.

As to size of blocks, most machine makers appear to have adopted the standard dimensions of 32 in. in length by 9 in. in height, giving 2 sq. ft. of face to each block. Machines are generally made for blocks 8, 10 or 12 in. in thickness. Some machines are adjustable to allow blocks of either thickness to be made. Where the business will warant it, however, it saves time to have a machine for each size. An 8-in. wall is abundantly strong for foundations or walls of two-story dwellings, but in many cities the building code prohibits anything less than 12-in. walls for foundation and first story. There seems to be only small demand for the 10-in. block.

Machines are generally provided with attachments for making corner blocks. Arrangements for making 45-deg. and 30-deg. angle blocks, for bays and towers, are also desirable.

Tamping is generally done by hand, by means of iron rammers. Some well-equipped plants use pneumatic tampers, operated by compressed air, with considerable economy in labor and probably some improvement in density. Excellent results can, however, be obtained by hand-tamping, if the mixture is wet enough. Sticking to the plates may be largely prevented by rubbing the inside surface, when dry, with paraffine, animal or vegetable oil, or soft soap. Mineral oils, such as common lubricating oil, are less effective.

For good results, blocks must be kept under roof, protected from sun and wind, and frequently sprinkled, for at least five days, and preferably for seven days. They may then be piled up outside, and in dry weather should be kept moist by occasional sprinkling with hose for at least three weeks more. Blocks should never be built into a wall until at least four weeks old. Freshly made blocks will be found to shrink more than 1/16 in. in length, on seasoning a month, and if put into a building when only a few days old will develop unsightly cracks in the joints or through the blocks themselves.

In handling blocks from the machines the use of three-decked cars on tracks will be found a great saving in time and labor. In a factory so equipped, each machine, with two men tamping and one shoveling, will easily make 150 blocks, 32 in. long and 8 in. wide, in ten hours.

Well-made 1:5 Portland cement concrete, of good sand and gravel or limestone screenings, will have a compression strength at four weeks of over 2,000 lb. per square inch, and at one year of over 3,000 lb. Tests made at the Case School of Science showed that 3-in. cubes of 1½:6 Portland cement and gravel concrete had a compressive strength of 3,200 lb. per square inch at six weeks, a specific gravity of 2.17 and an absorption of water of 4.16 per cent. Similar cubes of 1½ parts cement, ½ part hydrated lime, and 6 parts of sand and gravel had a strength of 3,880 lb., specific gravity of 2.18 and absorption of 4.10. Cubes of 1½ parts of cement and 6 parts of limestone screenings, poured in a porous mold, had a strength of 2,000 lb., specific gravity of 2.05 and absorption of 5.04.

It is very difficult to obtain reliable crushing tests of actual hollow blocks, owing to the difficulty of applying the load uniformly over the whole surface. Three one-quarter blocks, 8 in. long, 8 in. wide, and 9 in. high, ten weeks old, made of cement 1¼, lime ½, sand and gravel 6, were crushed under loads of 2,000, 1,805 and 1,530 lb. per square inch. Two blocks, 6 x 8 x 9 in., twenty-two months old, showed a crushing strength of 2,530 and 2,610 lb. If it were not for the question of water absorption, much poorer mixtures than are generally used would give abundant strength. Where water-proof qualities are no object, and good gravel containing plenty of coarse pebbles is to be had, mixtures as poor as 1:8 or 1:10 will often be found to answer. The accompanying table of tests of various mixtures, made by Prof. Newberry, shows the good results that can be obtained with low proportions of cement, especially with the addition of hydrate lime. It should be remembered that the compression strength of concrete is generally about ten times its tensile strength. The water absorption given is the percentage of water, by weight, which the dry block absorbed after soaking twenty-four hours. The tensile strengths are the average of four briquettes each. The sand used was a coarse bank sand, containing very little gravel. The cost of material is based on assumed price of $1.50 per barrel for cement, $5 per ton for hydrate lime, and 25 cents per ton for sand, and is stated in cents per 8-in. block, 32 in. long.

COST AND PROPERTIES OF CONCRETE BLOCKS.

Proportions by weight.			Tensile strength 22 days,	Wt. per cu. ft.,	Water Absorption.	Cost materials for block.
Cem.	Lime.	Sand.	lbs.	lbs.	%	cts.
150	0	600	334	130.0	7.72	11.2
125	25	600	360	136.4	5.75	10.6
100	50	600	278	139.5	5.23	10.0
100	25	600	197	136.0	5.75	9.0
50	50	600	182	132.6	7.03	6.7

It will be noted that the hydrate lime considerably decreases the water absorption, and in small proportions increases the strength. The last mixture, 1:1:12, appears strong enough for all practical purposes, and is actually less permeable than the first, consisting of cement and sand, 1:4, without lime. It is evident that in the vast sections of our country in which sand and gravel are to be had, almost without cost, in unlimited quantities, concrete blocks made from such a mixture would be far cheaper than lumber, and ought easily to replace all other building materials. All that is needed to bring this about is practical demonstration, and the requisite skill and ingenuity on the part of architects and builders. It is conceivable that a type of construction for small dwellings, using a 4-in. or 5-in. hollow block, might easily be developed, and these could be turned out, two at a time, on 8-in. or 10-in. machines, provided with suitable cores and partition. The possibilities of development in this direction seem almost limitless.

One of the chief faults often observed in work done with concrete blocks is their tendency to absorb water to such an extent as to cause dampness to appear on the interior surface. This is especially noticeable in blocks poor in cement and made too dry. The fault may be overcome by use of suitable materials and sufficient care in manufacture.

The terms porosity and "permeability" are often used, and by many supposed to be of the same meaning. The porosity of concrete is, however, the proportion of voids it contains, while the permeability is the rate of speed with which water, under a certain pressure, will pass through it. All concretes and mortars are more or less porous, and all are somewhat permeable by water under heavy pressure. It is well known that, with the same proportions of cement, mixtures of fine sand are more porous than those of coarse sand. The latter are, however, much more permeable than the former. Feret has shown that the porosity is the total amount of voids contained in the mass, while the permeability depends on the size of the individual openings. The least porous concrete may, therefore, be the most permeable, and vice versa. If, however, both fine and coarse grains are present in proper proportion, the mass will show the least porosity and at the same time be the least permeable.

If a concrete block be immersed in water it will gradually absorb the liquid, and in time the amount of water taken up will be nearly equal to the total of voids present. The rapidity with which this absorption takes place will differ greatly, however, with different mixtures of the same porosity; blocks containing fine material in the right proportion will be found to absorb water much more slowly than those made from coarse materials only. It is the speed with which the water is absorbed that is of consequence in the case of concrete blocks, rather than the total amount which will be taken up after a long time. If the absorption is slow the moisture during a long-continued rain will penetrate only partially through the block, and will dry out again before the surface is again wetted. Perfectly water-proof walls are not necessary, and are even objectionable, owing to their tendency to "sweat" from the deposition of moisture on the inside surface. For health and dryness it is necessary that a gradual circulation of air through the walls should take place, and that any moisture condensing on the inside shall be absorbed and carried away.

Sufficiently impermeability for practical purposes, to avoid all danger of dampness penetrating from the outside, may be secured by use of a sufficiently large proportion of cement, the addition of hydrate lime, and suitable sand and gravel or screenings, containing both fine and coarse material. With poorer mixtures, which would otherwise be too absorbent for use in the walls of dwellings, any desired water proof qualities may be secured, Prof. Newberry claims, by the addition of a very small percentage of water-proof compound he has invented.

The natural stone color obtained by the use of ordinary sand and gravel or screenings, is more popular with purchasers of blocks than any tint which may be given by addition of pigments to the mixture. Limestone screenings give a lighter color than most kinds of sand, but the color is chiefly determined by the cement used, and the tint obtained with white sand is very little lighter than that with sand of ordinary gray shade. The addition of hydrated lime makes the blocks decidedly lighter in color, and the same result is obtained, in still greater degree, by making the mixture as wet as possible. The difference between blocks made fairly wet and those made too dry will be found to be very striking.

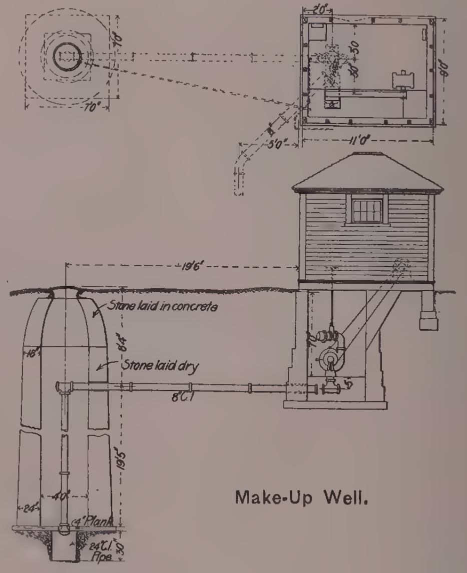
Colored blocks, imitating various tints of natural stone, may be obtained by a facing of richer mixture to which from 1 to 3 per cent. of dry mineral color has been added. The colors most suitable are: red iron ore paint or Venetian red, yellow ochre, ultramarine blue and ultramarine green. These are inexpensive, and may be mixed to any desired shade. It must be remembered that all cement work bleaches and whitens decidedly on hardening and drying. The color of the freshly made blocks must therefore be much deeper than it will appear after a few weeks' exposure to weather. Deep and strong colors are, in fact, difficult to secure in cement work.

The Power Plant of the Boston & Worcester Street Railway.

By Howard S. Knowlton.

An interesting example of power station evolution is furnished by the plant of the Boston & Worcester Street Railway Co., at South Framingham, Mass. Placed in operation in 1902 with a capacity of 1,500 k.w. in direct-connected engine-driven generating units, the plant has recently been extended by the addition of 2,000 k.w. in steam turbine equipment, including the largest cooling tower outfit in operation in New England, if not in the entire East. The Boston & Worcester system is familiar to engineers as one of the few strictly high speed interurban electric lines in New England. Its main line traverses a direct route of 40 miles between the two largest cities of Massachusetts, the trackage being double, with the exception of about 5 miles in the middle of the run.

The power plant is located on the banks of the Sudbury River, about a mile north of the business centre of South Framingham and practically at the center of electrical distribution for the road. The station is connected with the New York, New Haven & Hartford R. R. by a spur track leading into the property, which enables rapid delivery of coal to be made to a bin situated close to the boiler room and just outside the station building. This is a red brick structure with granite trimmings, and is 182 ft. 8 in. long by 105 ft. 4 in. wide. Natural draft is provided by a 185-ft. brick stack having an inside diameter of 8 ft. About 150 tons of steel, supplied by the American Bridge Co., were used in the frame. This includes the roof trusses and the frame of the engine room floor, the latter being made up of brick arches with 4 in. of concrete covered with 1 in. of Portland cement. The stack is capped by sectional cast-iron plates and provided with a ladder and lightning rods. The first 35 ft. is of square section and the remainder is round, tapering to a slightly spreading top. The outer wall is separated from the inner core by an air space extending the entire length. The foundations were Portland cement concrete, the excavations being carried 12 ft. below the basement floor level.

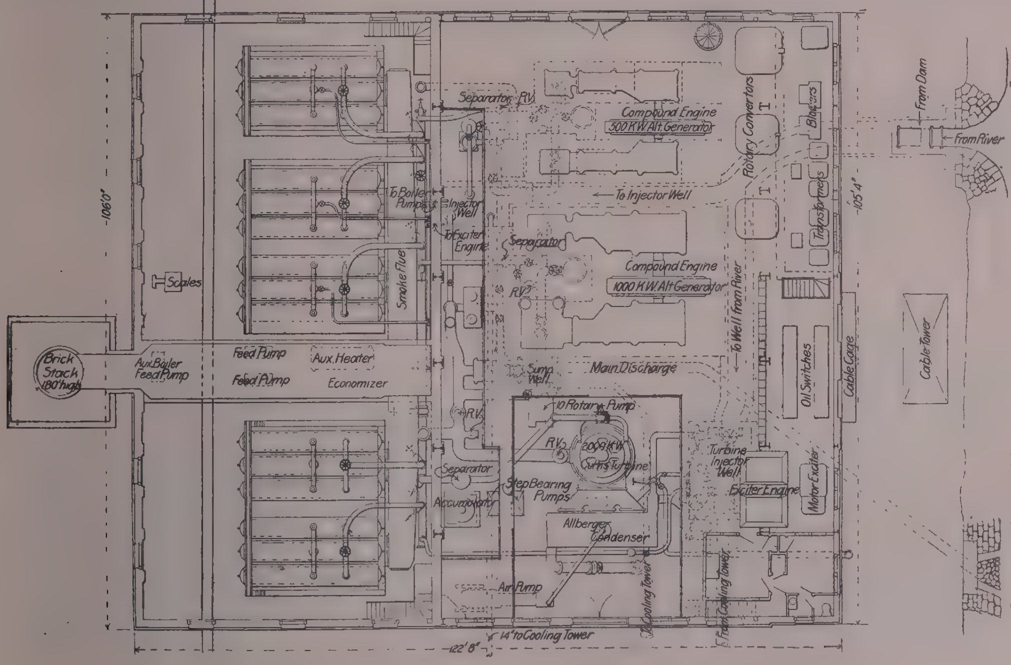


Make-Up Well.

The building is divided by a fire wall into the usual boiler and engine rooms. Beneath the latter and on a level with the former is a basement 12 ft. high, which is in reality the first story and at the same grade as the yard outside. Here are located the pumps, heaters, condensers and all large piping, besides the transformer air ducts. Stairs provided with "Universal" treads connect the basement with the engine room, and an open well surrounding the turbine outfit permits easy inspection from above. The engine room is traversed by a 50,000-lb. Whiting crane.

In the boiler room the main features are its excellent ventilation, lighting and general accessibility. The boilers are of the horizontal style, set in three batteries aggregating 2,800 h.p. All are Aultman & Taylor horizontal water-tube type, operating at 150 lb. steam pressure. Hand firing is employed. A Green economizer containing a total heating surface of 9,212 sq. ft., is installed with the usual by-pass for discharging the flue gases directly into the chimney. A feed-water by-pass is also provided around the economizer.

The entire system of water supply and piping has been developed with great care in order to meet the unusually exacting demands of the situation. Unfortunately, the Sudbury River does not permit the use of as much water at all seasons of the year as the station would require if it had been further developed along the lines of the design of the original 1,500-kw. plant. Over 6,000,000 gal. per 24 hours are now required for condensing and boiler feeding, and on account of the low water in the river and the rights of other consumers the plant is limited in times of drought to about 25 per cent. of this amount. Hence, when the 2,000-kw. turbine was purchased, it was decided to install a complete cooling tower plant which would enable the water at such times of insufficient river supply or at other times desirable, to be used over and over, the loss by evaporation being made up either from the river or from a well located about 200 ft. south of the station. The cooling towers and condensing equipment were supplied by the Alberger Condenser Co., of New York. Three towers are installed, the central one being about 90 ft. east of the power house and close to the river bank.



Plan of Power Station, Boston & Worcester Street Railway.

The condensing equipment of the original engine-driven units was supplied by the International Steam Pump Co. Fresh injection water for this apparatus and also for the new equipment is drawn from the river through a concrete canal supplied either from the river at the power house or through a 36-in. pipe leading to a dam 500 ft. upstream, which gives an additional head of 2 ft. at times of low water. The canal is provided with a screen and gate at its mouth, and as it passes beneath the power house it divides into two branches, one of which supplies the injection well of the original equipment and the other the turbine injection well. The 500-kw. generating unit discharges into a Deane air pump and jet condenser, a Blake jet condenser being installed with the 1,000 kw. unit. Heaters were furnished by the Whitlock Coil Pipe Co., of New Haven. The feed pumps are all of the 10 x 6 x 12-in. duplex type, two being of Deane make and one Smith-Vaile.

The 2,000-kw. turbine is a Curtis machine using about 40,000 lb. of steam per hour at normal load, and any two of the three towers are guaranteed to handle the circulating water for the condenser of this turbine when working under 27 in. of vacuum. The exhaust from the turbine passes into a counter-current Alberger surface condenser containing 12,000 sq. ft. of cooling surface, whence the water of condensation is pumped through a 4-in. discharge pipe to a receiving tank in the southeast corner of the engine room, after which it is passed to the circulating return pipe leading from the cooling towers to the power house. Any one of the cooling towers is guaranteed to handle the circulating water for the 1,000-kw. engine unit when condensing from 20,000 to 25,000 lb. of steam per hour, taking the water at a temperature not lower than 10° below that of the steam, and maintaining from 26 to 27 in. vacuum. All three towers will handle the circulating water for the turbine when the latter is operating at 50 per cent. overload in summer weather at 80° temperature, using 60,000 lb. of steam per hour and maintaining a 27-in. vacuum with the barometer at 30 in. The Alberger Co. provided the following pumps in connection with this equipment: A horizontal 8 x 18 x 24-in. Corliss dry vacuum pump, occupying a floor space of 17 x 4 ft. 11 in. and having an air pipe from the condenser 6 in. in diameter; a Lawrence 50-h.-p. motor-driven volute centrifugal pump; a 5¾ x 6¾ x 8 in. horizontal duplex hot well pump. The railway company also installed, in addition, two De Laval turbine-centrifugal pumps for use in connection with the Alberger apparatus. The overall dimensions of the condenser are: length, 19 ft. 9 in.; width, 7 ft. 5 in.; height, 9 ft. 4⅝ in.; number of tubes, 2,865. The De Laval pumps deliver the circulating water against a pressure corresponding to a head of 45 ft.; one is rated at 55 h.p., and the other at 110 h.p. Two sizes of pumps were selected in order to facilitate operation at times without the cooling towers and at times with cold water.

The volute centrifugal pump delivers the discharge water from the jet condensers of the engine-driven sets to the cooling towers. It is connected with a sump well 12 ft. deep, the latter being equipped with a float which automatically regulates the discharge through a vertical rod and butterfly valve in the 12-in. outlet pipe. This well is also provided with an overflow connection leading to the river, so that any water not pumped to the cooling towers may be disposed of. The driving motor is of the induction type and operates at 500 r.p.m. on a 350-volt, three-phase circuit. All of the circulating system is cross connected with pipe lines from an intake well at the river so that during part of the year or when the load on the plant is light, river water can be used, sometimes helping out the condensers by using only one tower together with the river water and again using river water altogether, if the turbine is shut down.

The cooling towers are each 22 ft. in diameter and 33 ft. high. Each is equipped with two 9-ft. diameter semi-pressure fans, which run 300 r.p.m. Each pair of fans is driven on a common shaft by a 40-h.-p., 350-volt, three-phase General Electric induction motor, installed in a motor house at one side of the towers. The motors are belted to the fan shafts and are provided with oil switches. Louvres are set in the side of the fan house to facilitate the ingress of air. Each tower is provided with a 14-in. hot water inlet and the water from all three towers is drawn off at one end from the cold tanks through a 24-in. suction pipe that leads into the turbine injection well. The cold tanks are in the tower foundations, and are concrete pits 12 ft. deep, connected to form a continuous reservoir. The cooling towers are guaranteed not to evaporate any more water by the process of heat extraction than the amount of feed water required, so that when the towers are in operation the feed water supply is the only outside supply continually required.

The turbine step bearing is cooled by water under a pressure of 400 lb. per square inch, the pressure being provided by two 7½ x 2 x 6-in. steam-driven Worthington duplex pumps. The water from the step bearing flows into the turbine base and thence to the condenser and hot well. The cooling towers are by-passed to the river.

The discharge from the surface condenser is carried in a 20-in. cast-iron pipe into a 24-in. pipe in which all the circulating water to be cooled is carried from the power house to the towers. The large size of the surface condenser is due to the high temperature attained by the circulating water in hot weather. This often exceeds 80° or 90°, and requires unusually liberal cooling surface.

The make-up well in the rear of the station is about 27 ft. deep. An 11 x 9-ft. wooden gate and motor house stands about 20 ft. from the well, and it is connected with the latter by an 6-in. pipe which leads to a centrifugal pump in a pit beneath the house. The pump is driven by a belted motor which forces the water through a pipe line to the cooling tower outlet pipe.

Throughout the piping system extra heavy valves and fittings are used where live steam is carried. The Holly system is used to return all drips to the boilers. The steam main is 14 in. in diameter, supported three ft. above the floor at the rear of the boilers, upon adjustable roller brackets. The valves are unusually handy. The pumps are supplied with live steam through a 6-in. main. Chapman gate valves, Pratt & Cady globe valves and Cochrane separators are in use. The steam turbine is supplied by a 10-in. main, which is the only pipe in the engine room proper that projects above the floor line. The leads from the boilers to the steam main are of mild steel, with long-turn bends to take care of expansion.

The engine-driven units are both Rice-Sargent horizontal cross compounds, direct-connected to General Electric revolving field alternators. The larger engine has 24 x 48 x 48-in. cylinders; it is rated at from 1,500 to 2,500 h.p. according to the cut-off, and runs at 107 r.p.m. The smaller machine is a 20 x 40 x 42-in. engine rated at 800 to 1,500 h.p., 107 r.p.m. The momentary speed variation is guaranteed not to exceed 3 per cent. The flywheel effect of the revolving field of the larger unit is 81,700 lb. at 5.42 ft. radius, and that of the smaller, 50,000 lb. at 4.4 ft. radius. The specified speed variation between no load and full load is not over 1 per cent. The governors are adjustable while running, to assist in parallel operation. The Curtis turbo-alternator is a four-pole machine with a revolving field and speed of 750 r.p.m. The turbine is of the four-stage type and is one of the General Electric Company's standard vertical machines. All of the alternators deliver three-phase, 25-cycle current at 13,200 volts. The exciters comprise two steam-driven sets and one motor-driven outfit, all located in the engine room. The two former are 35 kw. machines direct coupled to General Electric marine engines running 305 r.p.m. The latter consists of a 50 kw. generator, driven by a 75 h.p., 350-volt induction motor making 150 r.p.m.

The switchboard is of standard General Electric construction, in the main. The usual complement of high tension oil switches is installed and from the power house the 13,200-volt circuits are carried to the substations of the railway. In the power plant itself are set up two 250 kw. General Electric rotary converters, supplied from six 100 kw. air cooled transformers, and one 500 kw. six-phase rotary, which draws its current from a 550 kw. three-phase transformer. The alternating-current sides of the rotaries are operated at 370 volts and the direct-current sides at 600 volts. The rotaries feed the trolley in the vicinity of the main plant, constituting a local substation at the power house.

The other substations are as follows:

Location.	Dist. from St., miles.	Rotaries.	Transformers.	Phases.
Wellesley ...	10	2—400 kw.	6—145 kw.	Single
Marlboro ...	8	2—250 kw.	6—100 kw.	Single
Westboro	11.5	2—250 kw.	6—100 kw.	Single
		1—500 kw.	1—550 kw.	Three

The 13,200-volt lines are of weather-proof insulated copper wire, except in places where dense foliage requires the use of three-phase lead-covered cables. The weather-proof insulation was used in deference to a local sentiment against bare wire and not on account of any belief in its protective value. When the cables are carried over trolley wires, wooden sheathing has been provided to prevent injury to the lead covering by stray trolley poles. A galvanized iron lightning arrester house has been erected some 15 ft. above ground in Framingham Center, where the wire lines and the cables are joined to one another. An interesting operating arrangement at the power house is a switch tripping circuit connected with the main office of the company at Framingham Junction. In case a dispatcher makes an error in car orders that might cause an accident, the opening of a switch at his right hand cuts off all power from the entire road in 7 seconds.

The contractors for the building were J. M. Bishop & Co., of Worcester, Mass., and the power plant was designed and its construction supervised by Mr. E. H. Kitfield, consulting engineer, Boston. The general superintendent of the road is Mr. E. P. Shaw, Jr., and the electrical engineer, Mr. M. V. Ayres. The chief engineer of the plant is Mr. A. F. Lovering, and the management of the road is centered in Messrs. James F. Shaw & Co., of Boston, who financed and built it.

Power Station of the Boston & Worcester Street Railway.

The Design of Large Gas Engines.

At the recent convention of the American Street Railway Association Mr. Arthur West read a paper on the design of large gas engines in which he first took up the arrangement of the cylinders. In a single-cylinder, single-acting, four-cycle engine an explosion takes place once in every two revolutions. In order, therefore, to get the same rotative effect as with a double-acting steam cylinder, it is necessary to work four single-acting cylinders on the shaft or two double-acting gas cylinders tandem on one crank pin. With this arrangement four explosions are obtained in two revolutions, or an explosion every 180 deg. of crank angle. In case of a misfire or premature ignition due to bad gas, the crank can only move one-half a turn before another explosion takes place. In a single-cylinder, single-acting engine the crank must move two whole turns before the next explosion, while with two single-acting cylinders opposed to each other or one double-acting cylinder the crank may be required to move one and one-half turns before the next explosion. The relative evil effects of a premature or misfire are, therefore, in the following ratios: Two double-acting cylinders, 1; two single-acting cylinders, opposed type, 3; one double-acting cylinder, 3; one single-acting cylinder, 4.

Gas engines and producers to be commercially successful must be designed to be run with the same class of help as is employed on Corliss engines and boilers. This being the case, misfires and prematures are liable to occur occasionally, and the designer must minimize their possibilities for evil. These considerations, as well as the capacity for caring for heavily swinging railway loads, have caused the adoption of tandem double-acting cylinders for railway work by the Westinghouse Machine Co.

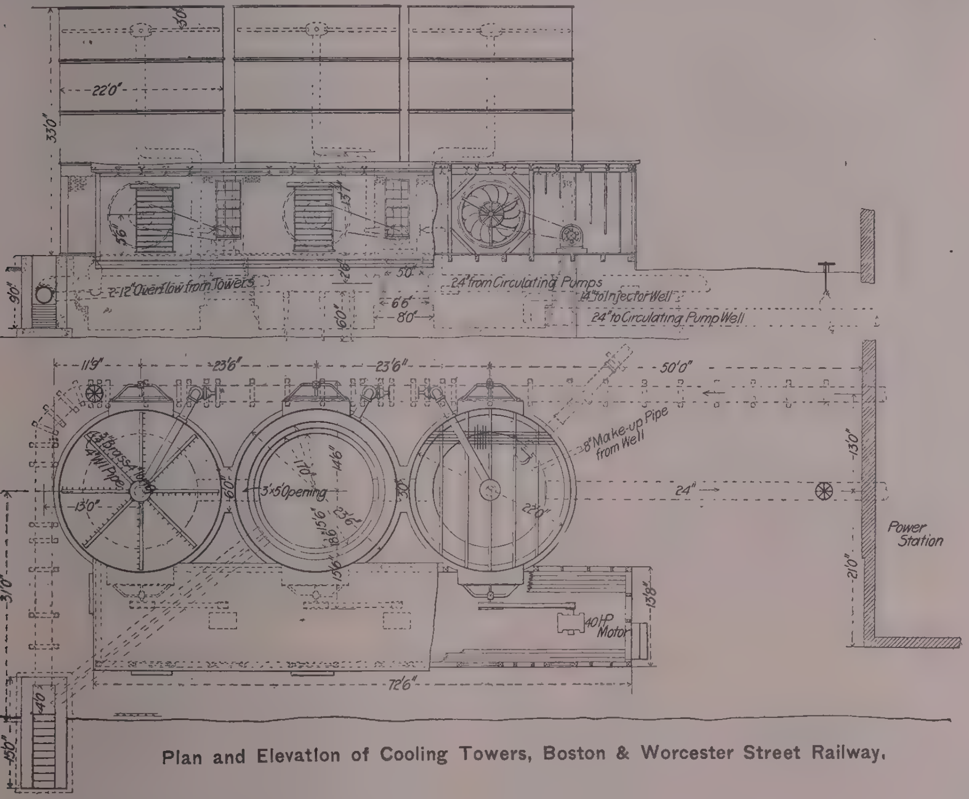
It is sometimes argued that cylinders so arranged are inaccessible. If, as is the practice of the Westinghouse Co., ample space is arranged between the cylinders, and if the inlet and exhaust valves are not located in the heads but in the cylinder body and entirely above the floor level, such a gas engine is as accessible as a tandem compound Corliss engine or as a Corliss engine driving an air compressor.

The speed of a gas engine must be adapted to the kind of generator to which it is to be directly connected. In a general way, its speed will usually somewhat exceed that of a Corliss engine of the same cylinder dimensions. In Mr. West's experience, the speed of large steam engines is limited by the inertia and consequent wear and tear of the valve gear rather than by the inertia of the reciprocating parts themselves, which is absorbed by the compression. Inasmuch as in a four-cycle gas engine the valve gear only moves at half the speed of the engine, somewhat higher speeds are permissible than would be the case with a steam engine having the same dimensions of cylinders.

The speed regulation adopted for large Westinghouse gas engines is especially suitable for generator driving in that no conditions of changeable load or variable friction of valve gear affect the regulator. The gas engine regulator governs the speed by means of a relay cylinder, and, therefore, produces results similar in type to those obtained with the relay governor used by the Westinghouse Machine Co. on steam turbines. The advantage of such a governor with the gas engine is that the varying friction of valves with different qualities of gas does not affect the sensitiveness of the governor. Without a relay cylinder the only way in which this result can be accomplished on large gas engines is by some form of a drop cut-off controlling the gas. This is objectionable on a gas engine, as any slight change in the speed of the dash pot very seriously affects the mixture of gas and air, with corresponding bad effect on the regulation. Such small changes in speed of dash pots are frequent in a Corliss engine, where they cause no bad results. The Westinghouse arrangement employs no releasing gear of any kind, but secures all the advantages of regulation without its use.

The European designer of gas engines has allowed himself an amount of complication in valve gear which would not be permissible under American operating conditions. The successful American machine must be as nearly "fool proof" as is the large Corliss engine. If it is not, it will fail to be a success from the purchaser's point of view—no matter what thermal efficiency may be claimed by the builders—as a consequence of such complication as the European engineers have been prone to adopt. In the designing of valve gear for large gas engines, wide range of quality of gases must be considered. In this respect the design of the gas engine is very different from that of a steam engine, inasmuch as the steam used has practically constant characteristics, differing only in such minor points as pressure and superheat. With the different kinds of gas to be met with, however, the proportions of air and gas, and sometimes of compression, are radically different, and no gear can hope to be a universal success which does not provide for meeting the widely varying conditions to be encountered in the market.

The question is frequently asked, "what is the overload capacity of the gas engine?" A clear understanding on the part of the purchaser of the limitations in this direction is very desirable, from the point of view both of the buyer and the seller. A gas engine and producer is thermally very much more efficient than a steam engine and boiler. With a well designed producer and gas engine plant, a horse power can be delivered with one-half the cost of fuel that is possible with a well designed steam engine plant. The power of the gas engine, however, is limited by the total volume of explosive mixture which can be drawn into the cylinders during the suction stroke, compressed and finally ignited. This condition sets a limit which does not allow of a large temporary increase of the power, such as obtained with the Westinghouse steam turbine by the automatic operation of the secondary admission valve. Such overload capacity is, of course, convenient for the purchaser, but it is unobtainable on a gas engine, unless the engine is largely under-rated, and the purchaser should consider that this is one of the prices that he pays for the enormously increased output obtained with the gas engine per pound of coal. The overload capacity is, therefore, simply the amount which the builder rates his machine below its ultimate capacity. It has been the Westinghouse practice to rate gas engines in such a way that they would have a safe overload capacity of ten per cent. The machines are ordinarily good for somewhat more than this, but conservative engineering requires that there be a margin of power in order that overloads may not materially reduce the speed. For ordinary cases the overload capacity of the generator and that of the gas engine should be about equal, in Mr. West's opinion, although the gas engine will indefinitely carry its overload while the generator will not, in all cases, unless it is bought with that understanding.



Plan and Elevation of Cooling Towers, Boston & Worcester Street Railway.

The mechanical efficiency of a large gas engine is very much greater with a four-stroke cycle than with a two-stroke cycle, this being one of the arguments against the two-cycle engine. It is no uncommon thing to see two-cycle engines which do not realize as brake horse power more than 60 per cent. of the work actually done by the combustion in the cylinders. The efficiency of a four-cycle engine varies considerably, but it may be said in a general way that a well-designed engine will deliver about 85 per cent. of the gas indicated horse power in the form of brake horse power. This 15 per cent. of power lost is not exclusively composed of frictional resistance of journals, cross-head slides, etc., as is the case in a steam engine. The four-cycle engine has, of course, to draw in its own mixture of air and gas and compress the same, and its functions, therefore, combine those of a pump, a compressor and a motor. It is the pumping and compressing work which causes the mechanical efficiency of the gas engine to be somewhat lower than that of a steam engine. The actual friction of the working parts need be no greater than with a well constructed Corliss engine, viz., 90 to 95 per cent. In order to keep down the friction and increase the reliability of the machines, it is the practice of the Westinghouse Co. to design large gas engines with provisions for attaching a continuous return oiling system. The large amount of oil put through the journals increases the safety, requires less attendance and keying up, and washes out dust if the engine is required to operate in an atmosphere which is not clean.

The thermodynamic efficiency of the gas engine varies so much with different kinds of gas that it is hard to say just what the average value would be. It is probably not far from the truth, however, that its thermal efficiency is about 25 per cent., though in favorable cases gas engines have obtained efficiencies well over 30 per cent.

There is an impression rather prevalent that a gas engine is uncertain and hard to start. A properly designed engine, supplied with fairly decent gas, can be started as easily as a steam engine. Large Westinghouse horizontal gas engines are started by means of compressed air, the only operations required being, (1) open the main gas valve; (2) close the igniter circuit; (3) open one compressed air valve, similar in construction to an engine throttle. The compressed air puts the engine in motion, which draws the charge into the cylinders and compresses it, after which the first explosion takes place. Air is shut off and the engine is in full operation. Mr. West said there was no more difficulty in starting gas engines than a steam engine of comparative size.

With certain kinds of gas, inspection of the interior parts of the cylinders is often desirable at regular intervals of, say, a couple of months. This is especially the case with blast furnace gas, and also with producer gas made from certain kinds of fuel. The Westinghouse Co. has taken particular pains to arrange its cylinders so that no parts of the valve gear or valves are below the floor. The inlet valves being located directly on the top of the cylinder, easy access can be had to either end of either cylinder by removing the inlet bonnets. The exhaust valves are also a part of the engine which need occasional attention for regrinding. Especial care has been taken to render these quite easily removable. The cylinders are, therefore, directly accessible from the top through the inlet openings and from the bottom through the exhaust openings. The fact that all the valve parts are entirely above the floor line renders these operations much easier than if a large part of the valve gear extended downward into foundation parts. It is not necessary to remove the cylinder heads, except to examine the piston rings themselves, which is not often required. Inasmuch as clean gas cannot always be secured, the importance of such easy entrance to the gas cylinders cannot be overestimated.

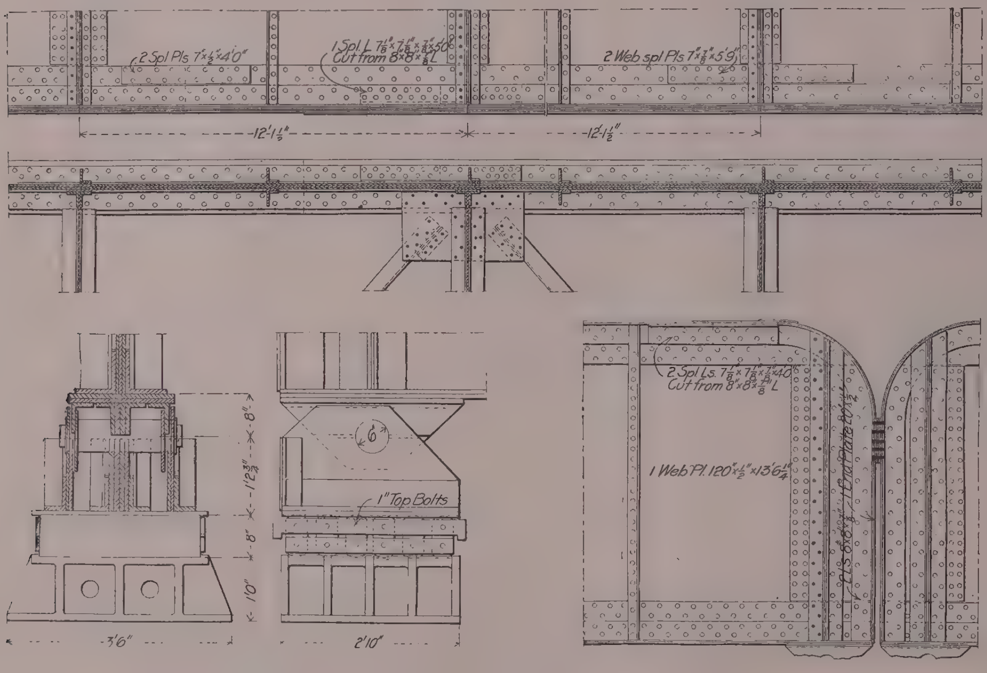
The Effect of Wide Tires on Traction.

The effect of wide tires on traction on different classes of roads is well shown in some experiments made by the Civil Engineering Department of the Iowa State College. The tires were 1⅝ and 3⅛ in. wide. On a well-drained earth road of good grade the traction with wide tires was a little higher with slushy snow and while the frost was coming out, and at other times it ranged 20 lb. less to the same figure as with narrow tires. On a badly drained earth road with poor grades, subjected to heavy travel, the wide tires required less traction than the others in dry weather and more when there was mud. On a well-built, well-drained gravel road, the narrow tires required less traction except when the surface was wet or covered with loose gravel. On a road of fine sand with its surface flat with the ground, the wide tires required less pull in every case. On a well-drained gravel road with clay binder, the traction with narrow tires was lower than that with wide tires only when the surface was smooth and dry, and about the same facts were observed in experiments on a well-drained cinder road under heavy travel.

Canal Improvements in France since 1871 have cost $500,000,000, for which expenditure there are now over 3,000 miles of canals and 4,700 miles of improved river navigation. In Germany nearly $75,000,000 were spent for inland navigation improvements in 1890-99.

The Use of Derrick Cars in Erecting Long Girders.

The Indiana Harbor Railroad crosses the tracks of the Michigan Central and the Elgin, Joliet & Eastern Railroads on a skew bridge with two 110-ft. duplicate through-plate girder spans. The girders are skewed 10 ft. 1⅞ in. and are spaced 28 ft. apart on centers. They are divided by the floorbeams into panels 12 ft. 1½ in. long, except next the abutments where they are 11 ft. 6 15/16 in. The lateral system consists of single X-brace angles crossing two panels and riveted to horizontal connection plates engaging the lower flanges of the girders and floorbeams, being field riveted to the upper sides of the former and to the lower sides of the latter. These plates are notched to clear the vertical web-stiffener angles and have short angle clips to develop the strength of the vertical legs of the lateral angles. The floorbeam webs are made in three pieces spliced with wide shop-riveted cover plates. The end sections are short but project beyond the top flanges to provide connection with the vertical web stiffener angles of the main girders. They reach to the top flanges of the girders and being stiffened by inclined flange angles on their outer edges serve as sway braces for the girders. The floorbeams carry four lines of 24-in., 80-lb., I-beam stringers, web-connected to them with fourteen rivets at each end.



Flange and Web Splices, Bearings and Corner Details.

The girders have web plates 7/16 in. thick throughout, spliced at panel points with cover plates having four vertical rows of rivets in the center splices and six rows in the end splices. Both flanges are alike and are made with two 8x8x⅞-in angles, two 15x½-in. side plates and one 20x¾-in. cover plate, all full length, and one 20x¾ in, and three 20x⅝-in. part length cover plates. The ¾-in. cover plates are each made in three pieces, spliced by the overlapping ends of the outer plates. All the ⅝-in. plates are made in single pieces. Both the flange angles and flange side plates are made in two pieces each with splices opposite in top and bottom flanges, but staggered on opposite sides of the web as shown in the elevations of the center part of the bottom flange. The upper corners of the girders are round at both ends and the top flange angles and cover plate are spliced, as shown in the elevation of the end panels, making them continuous with the end verticals. The ends of adjacent girders on the pier are spaced 2 in. apart in the clear and are rigidly connected by field rivets through the end vertical angles and filler plates.

The girders have bearings on 6-in. pins through riveted triple-web shoes and pedestals as shown in the detail. The pedestals and shoes have half-hole bearings in the same planes thus eliminating bending moments and shear in the pin and reducing its stresses to simple compression. The reinforcement plates in the outer webs have full pin holes, thus locking them together. At the expansion ends the base plates of the pedestals have guide ribs planed on the outer edges to engage segmental rollers seated on cellular cast bolsters, 12 in. high with longitudinal and transverse webs 1½ in. thick. At the fixed ends the rollers are omitted and the pedestals are seated directly on the bolsters, both members being the same as for the expansion ends except that the longitudinal guide ribs are omitted. All the girder bearings on the abutments are expansion, and those on the pier are fixed, thus enabling the floor system to be rigidly attached to both spans and continuous over the pier which is built higher than the abutments to compensate for the omission of the rollers. The girders were designed in accordance with Cooper's specifications of 1901, and were built of medium steel and painted with three coats of National Paint Works No. 31 paint.

Each girder weighs 57 tons and was riveted up complete at the bridge shops, and each was shipped to the site loaded in the usual manner in a vertical plane on flat cars, provision being made for the girder to swivel and move longitudinally in passing around curves. A falsework of framed trestle bents was built between the abutments and stringers from the bridge were set on it to carry a standard gauge track on which the girders were successively delivered, each being proceeded and followed by a derrick car which unloaded it and seated it permanently, on the shoes which were previously set in position.

Erecting First Span with Derrick Cars.

The derrick cars are of special construction, designed by the erection contractor, and are built of steel and have a capacity of 100,000 lb. They are 52 ft. long with a solid plate floor supported on a rigid framework having two 32-in. longitudinal plate girders 10 ft. apart and 9-in. transverse channels 2½ ft. apart. The derrick is mounted on the forward end of the car and consists of a 24-ft. steel mast and A-frame and a 40-ft. boom with a capacity of 30 tons at an angle of 40 deg. with the horizontal. The boom can be extended to 60 ft. long and has then a capacity of 10 tons. It is rigged with an 8-part tackle with ¾-in. wire rope and 20-in. sheaves.

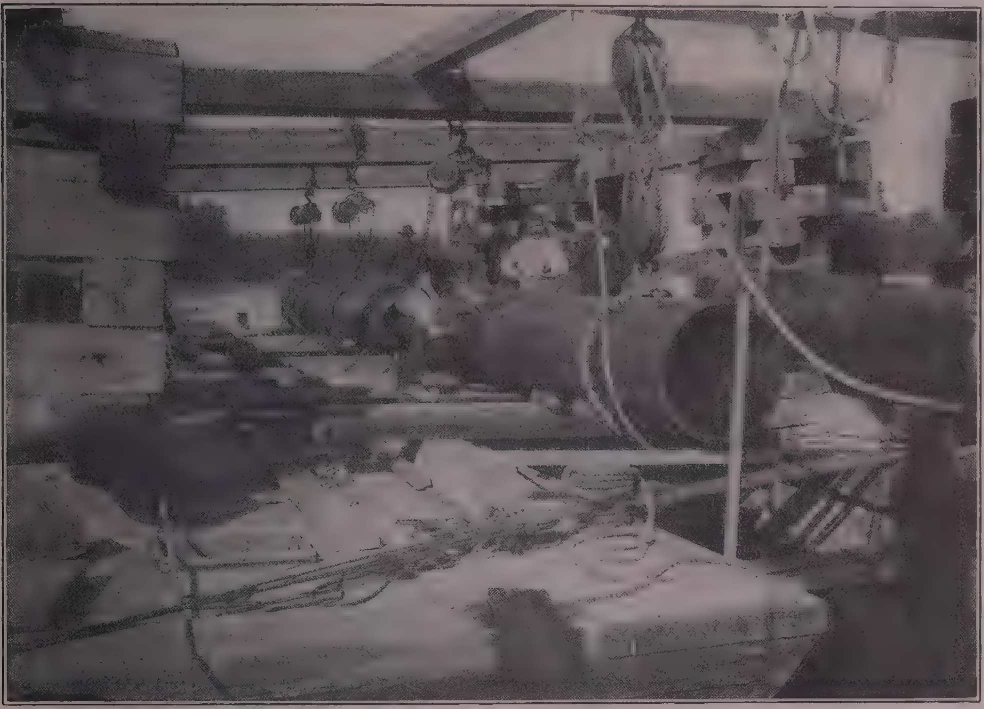
The rear end of the car is provided with about 8,000 lb. of counterweights in a box, and there are two rail clamps at each end of the car and two jack screws at the forward end to secure it for heavy loads. Connections are also provided at the top of the mast for side guys when it is necessary to swing heavy loads transverse to the car. The feet of the A-frame are connected to the car by two pins in each leg; when the forward pins are removed the A-frame can be revolved backwards to a nearly horizontal position, carrying with them the mast and lifting the foot of the latter from its seat. The boom can be disconnected from the mast and hauled back on the car, thus reducing the dimensions of the whole apparatus so that it has clearance for transportation through tunnels and bridges. The derrick is operated by a 30-h.p. Lidgerwood hoisting engine geared to the rear axle and able to propel the car at a variable speed up to a maximum of 8 miles per hour. These cars have proved very efficient and satisfactory for girder erection and have been used singly to erect 50,000-lb., 80-ft. deck girders.

The 110-ft. spans above described were designed and constructed under the direction of the engineering department of the Indiana Harbor Railroad Co., Mr. R. B. Seymour, chief engineer. Mr. W. M. Hughes, Chicago, was the consulting engineer, the girders were made by the American Bridge Co. and erected by the L. M. Bernheisel Construction Co., Evanston, Ill.

The Naval Civil Engineers are not much envied, evidently, for but three candidates appeared for examination this week for eight much-advertised vacancies.

Construction of a Submerged Outfall Sewer.

A 30-in. submerged cast-iron outfall sewer, 2,000 ft. long, is being laid to connect a portion of the sanitary sewerage system of New Rochelle, N. Y., with a submerged main outfall sewer which extends 3,000 ft. into Long Island Sound. The connection is being built across Echo Bay, an arm of the Sound, and through tidal flats whose surface is from 5 ft. below to 7 ft. above mean low tide. Mean high tide in the bay is 7.5 ft. above low water, but extreme high tides reach 10 ft. above that level. Two channels navigable by boats of considerable size are crossed by the pipe line, and in order to provide for future deepening of these waterways, the pipe is laid at a minimum depth of 13.2 ft. below mean low tide. The outfall is built as an inverted siphon, with a drop-well 6 ft. in diameter and 14 ft. deep at the shore end, and a rising well 27 ft. deep at the other end.



A Section of Pipe Ready to be Laid.

The drop-well is the outlet of a reinforced concrete sand catcher built near the edge of the flats at the junction between a 30-in. vitrified pipe from the sewerage system and the outfall. The sand catcher is 25 ft. square in plan, and has a minimum depth of 9 ft. to the springing lines of the flat barrel arches in its roof. It is built on a rock foundation, with its top, sides and bottom reinforced with No. 10 expanded metal, and with pilasters 1 ft. square in cross-section spaced around its side walls. The sewage enters at one corner and is drawn out at the middle of the opposite side through the drop-well, the top of which is 6 ft. above the bottom of the sand catcher and forms a semi-circular weir. A 30-in. vitrified pipe by-pass, 200 ft. long, discharges into the Bay. A 24-in. connection with this by-pass at the floor line of the sand catcher allows the lighter intercepted material to be flushed out of the latter, while the heavy materials will be removed through manholes in the roof. The by-pass, the flushing connection, and the inlet from the 30-in. vitrified pipe are controlled by sluice gates.

Solid rock lies at, or within a few feet of the surface of the mud bottom in the first 600 ft. of the trench beyond the sand catcher, and this portion of the trench is being made and the pipe laid in cofferdams. The ground in the first 150 ft. just beyond the sand catcher is about 1 ft. above water at extreme high tide, with two small islands further along in the cofferdam work. The trench through the higher ground and the islands was made in separate cofferdams, which were finally connected across the low places between them.

The cofferdams are built of one row of 2-in. sheet-piling on the high ground and the islands, and of two rows across the low ground. They are thoroughly cross-braced and made as water-tight as possible up to about 1.5 ft. above mean high tide only, the contractors considering that it is cheaper to pump them out if an occasional extreme tide floods them, than to maintain them above the highest tide level. Several Rand drills are used in making the blast holes for the rock excavation, which varies from 9 to 25 ft. in depth in the cofferdams. A 4-in. duplex reciprocating Worthington pump, a 6-in. centrifugal pump made by the Nagle Engine & Boiler Works, and a 6-in. Lawrence centrifugal pump are used to remove the water from the cofferdams. The excavated material is handled by derricks operated by Lidgerwood hoisting engines. The drills and pumps are operated by air from a compressor in a local electric power station about 1,000 ft. from the work or by steam from the boiler of a large dredge. The air and the steam supply connections are arranged so the plant may be shifted from one source of power to the other with little difficulty.

The rock slopes away from the surface beyond the islands and falls below the line of the outfall about 600 ft. from the end of the cofferdam. It is overlaid with 7 to 10 ft. of mud, while a hard clay underlies the mud from the point where the rock disappears below the line of the trench. The mud was first stripped from the rock and hard material with a small dipper dredge. The blast holes for the rock excavation outside of the cofferdams are made with Rand drills mounted on wooden blocks which slide between vertical guides on scows.

The submerged pipe laying was commenced about 80 ft. from the rising well at the connection with the main outfall sewer and carried continuously toward the other end. The pipe laying is carried on with the assistance of a diver, from two 25x60-ft. scows, one moored lengthwise on each side of the center line of the trench. The pipe is standard hub-and-spigot cast-iron water pipe, in 12-ft. lengths. Four lengths of pipe are placed on planks laid transversely to the line of the trench from one scow to the other, and the joints between the lengths made with jute and calked with lead. A chain sling is then placed around each 12-ft. length of the 48-ft. section thus made and the section raised by blocks and tackles on cross timbers overhead, the ends of the timbers resting on piles of 14x14-in. blocks on the scows. Three of the blocks and tackles are of the 3-way reciprocating type, made by Yale & Towne, and the chains through them are handled by men on the scows. The remaining block and tackle is of the usual wooden type, the rope in it being handled by a Lidgerwood hoisting engine on a pile driver boat just back of the scows and over the trench. The section of pipe is raised enough to permit the cross planks on which it rests to be removed, then it is lowered into the trench. The submarine joints between the sections are made by the diver. The pipe is lowered into place as nearly as possible; then the scows are shifted by the pile-driver boat until the section is in line. The spigot on the end of the section just lowered is next entered into the hub of the adjoining section already laid and a jute-packing and cold-lead joint made by the diver. Any material that has washed into the trench, as well as the high places in it are removed by the diver with a hydraulic jet, while the pipe is shimmed up over the low places until the dredge has backfilled the trench. The depth of water in the trench is so slight at low tide that the scows can be shifted and pipe laying carried on only at high tide.

The rising well at the end of the outfall under construction connects with the main outfall, 3,500 ft. long, leading into Long Island Sound. This main outfall is a 24-in. cast-iron pipe, the first 500 ft. of which is laid in a 6x8-ft. tunnel through a rocky point. The next 2,200 ft. is laid in a trench on the bottom of the Sound, while the last 800 ft. is placed 21½ ft. below mean low tide on a creosoted pile and timber foundation. The tunnel is used as a flushing chamber by allowing it to fill at high tide and then discharging the stored water through the outfall when the tide goes out.

The outfall connection is being laid by the Board of Sewer Commissioners of New Rochelle, composed of Messrs. George W. Sutton, Richard Lathers and H. J. Parker. Mr. James K. Wilkes is chief engineer of the Board. The work is being executed by the Seely-Taylor Co., of New York.

Regulations for Hollow Concrete Blocks.

Hollow concrete blocks are now permissible for Philadelphia buildings six stories or less high, under considerably less severe regulations than those of New York. They must be made of a mixture of 1 part Portland cement and not over 5 parts sand, gravel, crushed rock or other suitable aggregate. The hollow space must not exceed 33 per cent. in most cases, and in high buildings, the blocks for the lower stories must not have more than 20 to 25 per cent. hollow space. The thickness of the walls must not be less than that of brick walls. Where joists impose a concentrated load exceeding 2 tons, the blocks must be solid, and where the load exceeds 5 tons, the blocks for two courses and a width of 3 ft. below the joists must be solid. All cement used in the blocks must pass the specifications of the American Society for Testing Materials. Blocks 28 days old must have an average resistance to crushing of at least 1,000 lb. per square inch, no deduction being made for hollow spaces. No loads greater than 8 tons per square foot, including the weight of the wall, may be imposed on these blocks. No blocks can be used until the brand has been tested by some reliable laboratory for transverse and compressive strength, absorption and resistance to fire and freezing, in accordance with detailed requirements.

Heating System of the Squadron C Armory, Brooklyn, N. Y.

By J. Byers Holbrook, Consulting Engineer.

This building, now in the course of erection, occupies a gross plot area measuring 255 x 382 ft., and is located at the intersection of President St. and Bedford Ave. It is rectangular in shape, and is virtually divided into three parts, the administrative portion being at one end, the stable and rifle range, etc., on the President St. side, while the riding hall completes what is probably the largest armory of its kind in this country.

The riding hall, which is covered by an arched roof, furnishes an unobstructed tan bark ring measuring in the clear, 176 x 306 ft., with a net height under the roof arches at the middle of 66 ft., and offering, accordingly, an interior volume to be heated of over 3,885,000 cu. ft.

The administrative portion of the building, located on the west side, is two stories high, containing on the basement floor the kitchen, laundry, drying room, etc. On the first floor of this same portion are located the arms corridor, lounging room, quartermaster's room, pantry and other small rooms. Above these rooms on the second floor are located the officers', staff and general reception rooms.

The squad room, which is the largest room in the administrative portion of the building, takes in both first and second floors, while the janitor's living quarters are located on the third floor. By referring to the basement plan it will be noticed that the rifle range, which is directly under the stable corridor, has provision for mechanical ventilation, the latter system being connected by ducts to the exhaust fan in pent house. Provision is also made to insure the removal of vitiated air from the large locker and dressing room in corner.

The equipment of so large an armory of this character offered an interesting problem as to the heating, not only on account of the size of the building, but also as to the sub-divisions, the various floor levels and the difficulty of securing the desired places for locating the heating surfaces. As far as the administrative portion of the building is concerned this building presents conditions not unlike any other armories or structures of this type, but the heating of the drill hall portion is of some little interest.

The ordinary armory drill hall for infantry maneuvers requires naturally more heating surface than that which is necessary for a drill hall used for cavalry drills, for the reason that the heat given off by the horses has a marked tendency to warm the surrounding air. Furthermore, the riders, due to a more or less violent exercise, are naturally in a heated condition, and for these reasons alone no great amount of heat need be provided. Sufficient heating surface, however, is required to properly temper the air to make that portion of the hall occupied by the audience of a comfortable temperature, and to provide just sufficient heat as to guard against possible freezing of the tan bark.

The stables on the south side beneath the long balcony which open into the ring by means of runways, require little heat, and the amount installed is placed along the partition wall between stables and ring, as shown.

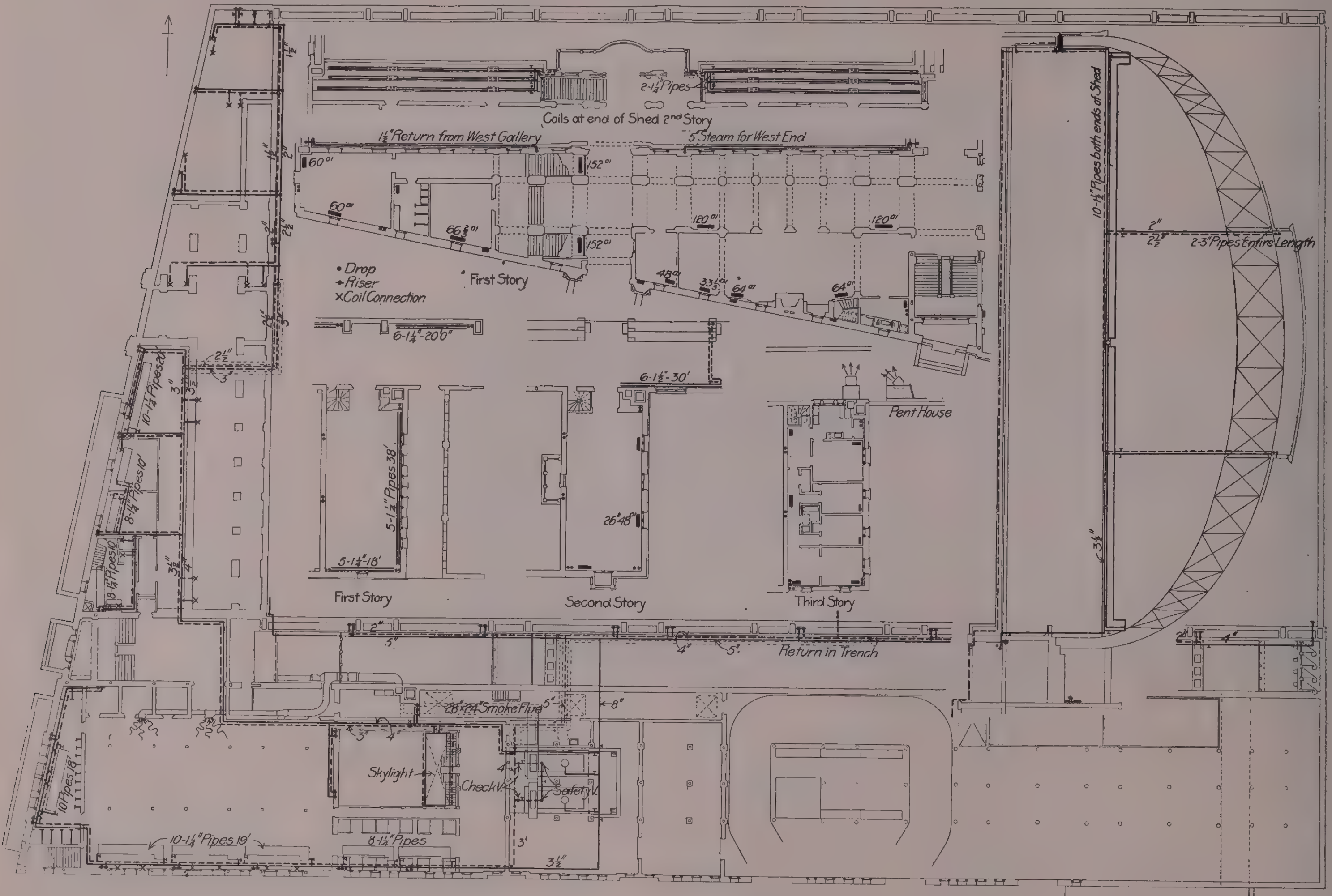
The heating is designed on the two-pipe, upfeed, low pressure, direct radiation system for the entire building. The various rooms, such as officers' quarters, staff room, arms corridor, etc., in fact all portions of the entire building, exclusive of locker room and some minor rooms and halls on basement and first floor, stables, balconies and drill halls are heated by the regular cast-iron type of radiators.

The upper ends of drill hall, which are of glass, have each two ten-row 1½-in. pipe coils 86 ft. long placed on ledges, as shown. Each of these coils has approximately 440 sq. ft. of heating surface, so that at the ends of the building there are 1,760 sq. ft. of radiation.

In the bays on the north wall are located eight coils, each 24 ft. long, made up of ten rows of 2-in. pipe, giving 150 sq. ft. of surface for each coil, or 1,200 sq. ft. of heating surface for all these bays.

The south, or general visitors' gallery, has seven coils placed at the rear of the seats along the wall and under the windows. Six of these coils (90 sq. ft.) are 30 ft. long, the last one (160 sq. ft.), at east end being 54 ft. in length. All of these coils are composed of six rows of 1½-in. pipe. This south gallery heating surface amounts in all to 1,360 sq. ft. of radiation. The west, or reviewing gallery, has in all six coils placed under the seats, as shown. Each coil consists of two rows of 1¼-in. pipe, 62 ft. long, furnishing 54 sq. ft. of heating surface per coil, or a total for this gallery of 324 sq. ft. of radiation.

To counteract cold downward drafts entering through the louvred openings in the roof monitor two 3-in. pipes are run the entire length of the monitor on each side, furnishing approximately 1,100 sq. ft. of radiation in all. From the above it will be seen that the total heating surface in this large drill hall is approximately 5,744 sq. ft. of radiation, and figuring on an interior volume to be heated of 3,885,000 cu. ft., this is allow-



Diagrams Showing Heating Installation in a Cavalry Armory in Brooklyn.

ing a ratio of 1 sq. ft. of radiation to every 676 cu. ft. of contents.

Steam is supplied by two boilers of the regular horizontal tubular type located in basement approximately under the western end of stables. Each boiler is 14 ft. long by 5 ft. in diameter, containing fifty-six 3½-in. tubes, aggregating not less than 850 sq. ft. of heating surface, and are tested up to a hydrostatic pressure of 100 lb. per square inch. These boilers are provided with 28 x 30-in. steam domes, from which connections are made to the heating system, as shown on basement plan.

From the rear of the boilers the smoke connection, made of No. 12 gauge iron, measuring 38 x 18-in., is taken off and connects to a 28 x 24-in. underground smoke flue, which in turn is led into a chimney located near the foul air flue. The boilers are provided with "Treadkill improved" shaking grates with ⅝-in. openings filling a furnace 4 in. wider than the boilers, and measuring approximately 5⅔ ft. long and containing not less than 30 sq. ft. of grate area. Sufficient additional space has been left for a third boiler should the same be required at a later date. Each boiler is provided with a "Ford" damper regulator, automatic water feeder, pop safety valve, and all required attachments and connections to properly manage the same.

Steam is supplied to the heating system from the 8-in. header, as shown, by a 3½-in. line running to the west portion and feeding all heating surfaces in southwestern portion of basement and those located on the floors above. An 8-in. line carries steam to two 5-in. mains in rifle range, one of these mains supplying risers, the latter feeding stable coils and coils in south gallery. The other 5-in. line in the range, besides supplying the remaining stable coils, is carried up in the corner of ring, as shown, feeding west gallery, administrative portion, large coils at west end, etc.

The 4-in. steam riser at the east end feeds in a similar way the east end wall coils, monitor coils, etc.

The returns from the administrative part of the building, from the west gallery, from the end wall coils, and from the north wall bays, it will be noticed, are all run together and carried back in a trench under the ring. This 4-in. return unites with a 2-in. return from the west end, and from this tee the return line is carried 5 in. back to the boilers. The returns from southwestern portion of building are led back through a 3-in. line, as shown.

For mechanically removing the foul air from the locker room and from rifle range, a 36-in. disc ventilating fan with direct attached motor is located in a small pent house on the roof adjacent to the foul air flue. A goose-neck discharge pipe, made of galvanized iron, extends from the fan casing in downward direction so as to protect fan and motor from rain.

The building is being erected from the plans of Messrs. Pilcher & Tachau, architects, of New York city, and the steam plant and the above described mechanical work was designed by the writer.

The Banking of Fires in the center of the grate, whether large or small, is stated by Mr. W. J. Allen in the "Engineer" to be more satisfactory than banking at the doors or bridge-wall. His custom is to have the fire clean and thin at shutting down time. He then places enough coal for banking in the middle, and after allowing it to burn briskly for 10 min. in the case of hard coal, the dampers are closed for the night. By the morning the fire has burned out clean all around the bank in the middle, which may then be spread out and quickly started.

Book Notes.

Engineers who are acquainted with French technical literature will be interested in the appearance of the fourteenth edition of de Laharpe's "Notes et Formules de l'Ingénieur et du Constructeur." This work is the French equivalent of the handbooks of Kent or Supplee, and over 100,000 copies of it have been sold. It is edited under the direction of Ch. Vigreux by Ch. Milandre and R.-P. Bouquet, who have made considerable changes in the text during the three years that have passed since the last edition appeared. The additions to the text have brought the total number of pages to 1,832. (Paris, E. Bernard, 1 Rue de Médicis; flexible leather, 12 fr. 50c.)

A book that will find a large circle of appreciative readers is Mr. William Nicholson's "Smoke Abatement." The author is the chief smoke inspector of the city of Sheffield, and his book is a manual for the use of manufacturers, engineers, inspectors and others interested in the suppression of this largely unnecessary nuisance. Much is being accomplished in many English cities in abating smoke, and there are plenty of laws which would have even better results could they be energetically enforced. It seems, however, that there, as well as in America, a man is always ready to applaud the fining of a neighbor for belching soot from his chimneys, but will vigorously oppose any attempt to stop his own similar acts. The value of the book lies in its explanation of the conditions in British cities, the laws that have been passed, and the methods of enforcing them. It is probable that some of the author's views concerning energetic action against infringers are too pronounced for adoption in America, but otherwise his suggestions are good. (London, Charles Griffin & Co.)

Building contractors engaged in New York City will find much valuable information in Mr. W. H. Hobbs' "Configuration of the Rock Floor of Greater New York," issued as bulletin 270 of the U. S. Geological Survey. The various engineering enterprises in the city have furnished more than 35 sections across the rivers which form the water front of the island. Many of them reveal the nature of the subjacent rock, and a number give nearly complete sections across it. The enormous building undertakings have resulted in a paring down of rock masses above the general cellar level, and most of the rock exposures described by early geologists can no longer be seen. After reviewing briefly the structural geologic studies made in the New York City area by earlier writers, Mr. Hobbs states that too little weight, in his opinion, has been accorded by recent observers to the importance of normal faulting in determining the structure of Manhattan Island. He describes a number of additional fault planes which have recently been located. The purpose of his investigation is to determine the depth and the nature of bed rock beneath Greater New York, through the medium of wells and borings, the numerous bridge and tunnel sections, the government dredgings, the reefs in midchannel, etc. It is believed that this work will aid not only in the solution of the geological problems of the area, but will be of assistance to those engaged in the great engineering enterprises now going forward on the island, as well as to architects, contractors and many others.

In the struggle between the railways and the Interstate Commerce Commission over rates, the latter contestant has considerable advantage over the former in obtaining publicity for its arguments. The proposal to give the Commission larger rate-making powers is not relished by the great number of people who have invested their savings in railway stocks and bonds any more than it is by the officers who have to earn money to pay interest and dividends on these countless investments. American railway rates are today the lowest in the world, and in most respects the service is the best. If the rates are reduced the service must inevitably deteriorate, for there is a limit to the extent to which our managers and engineers can surpass those of other countries. One reason for their success is the fact that they have been free from oppressive control, but if the rate-making power is taken from them, then the basis on which all their success has depended is no longer controlled by them, and government ownership without government responsibility is substituted for the old conditions. It is a strange socialistic development, and any one interested in it will find a complete proof of its injustice and impracticability in a book entitled "For the Railroads," published for free distribution by H. T. Newcomb, Bond Building, Washington. It is, of course, an ex parte statement prepared for the railways, but the argument is merely a statement of facts and is thoroughly convincing. All who have occasion to use railways for travel or freight will find the book well worth careful reading.

Soils and Fertilizers. By Harry Snyder. Easton, Pa., Chemical Publishing Co.; cloth, 12mo., 304 pp., $1.50.

Some years ago Prof. Snyder prepared a book entitled "The Chemistry of Soils and Fertilizers," which gave, in condensed form, the principles of chemistry bearing on the conservation of soil fertility and the economic use of manures. This book proved decidedly popular. Lately a committee of the Association of Agricultural Colleges and Experimental Stations has suggested a course of study and laboratory practice in soils, and Prof. Snyder has rewritten his former book, greatly enlarging it, to conform with that program. In its new form, bearing the title "Soils and Fertilizers," it contains much interesting information to engineers engaged in irrigation and sewage disposal.

The introduction is a brief sketch of the history of the scientific study of soils and fertilizers. The first chapter explains the physical properties of soils and the effect of cultivation, fertilizing and other influences. The next chapter discusses the geological formation and classification of soils, and the third their chemical composition. The fourth chapter takes up the ways in which nitrogen affects plant growth, and discusses the value of nitrogenous manures. The next chapter is on farm manures, and is followed by a brief one on fixation. Then follow chapters on phosphate, potash, lime and commercial fertilizers. Chapter 11 contains an interesting statement of the food requirements of different crops, and chapter 12 explains the scientific principles of rotation of crops. The thirteenth chapter describes the preparation of soils for crops, and will prove particularly useful to those who have charge of land receiving sewage. The last chapter describes the laboratory practice to be followed in investigations of soils and fertilizers.

Synchronous and Other Multiple Telegraphs. By Dr. Albert Cushing Crehore. New York, McGraw Publishing Co.; cloth, 8vo., 134 pp., $2.

This book contains a summary of the results of the author's theoretical and experimental studies to obtain independent telegraph circuits by the use of direct and alternating currents on the same wire. It is the first technical description of them which has been published, and is important because the principles have been tested for a number of years under rather difficult service conditions. The systems were first worked out in detail in the laboratory on artificial wires made to imitate real wires, and it is interesting to learn that when they were afterward applied to real wires almost identical results were obtained. This is particularly important with this subject, because its nature is such that the investigation must be mainly experimental rather than theoretical.

The book is divided into three parts. The first contains the results of the author's work, as previously stated, and is of practical value as describing means of obtaining double the telegraphic service from a single Morse, while retaining nearly all the advantages of a single Morse circuit. These methods are not related to the so-called "sine-wave" systems, in which an alternating current is automatically operated upon at or near the zero points. The second and third parts of the book relate to methods of obtaining telegraph circuits by means of the synchronous rotation of two bodies at distant points. In the second part the use of special wires for the sole purpose of synchronizing is advocated, and one method of operating such motors is given. The author considers it probable that in such installations there will be used some form of generator of alternating or reversed currents, distributing them from a central point in waves having a constant periodicity, which will be received by relays that control some form of synchronous motor driven by power from a local source.

A fourth edition of M. Aimé Witz's "Moteurs a Gaz et a Pétrole' has appeared in two 8vo. volumes of over 500 pages each. The first volume gives a theoretical and experimental investigation of gas engines, while the second describes the leading engines and explains their characteristic features and important details. The first volume is equally interesting from practical and theoretical viewpoints. After reviewing the history of gas engines down to 1903 and establishing a system for classifying them, M. Witz examines at length the fuels for them, illuminating gas, water gas, producer gas, blast furnace gas, carburetted gas, acetylene, gasoline and alcohol. An entire section is devoted to producers, steam injectors, blowers, suction producers and back-firing. The general theory of gas engines, published by the author in 1884 and widely adopted, is reviewed and developed with the greatest care, so as to answer all criticisms and satisfy the most rigid theoreticians, but the experimental theory, following Hirn, throws still more light on the subject and is more directly applicable to practical problems. This latter theory is, indeed, the chief work of the author. The tests of engines are criticised in detail, and the most important results obtained with the best engines are reported. This volume closes with an explanation of the methods of calculating the power of a given engine and of determining the leading dimensions of an engine built according to a given general program. In the second volume M. Witz describes 112 gas and 39 oil engines, explains their leading characteristics, and points out whatever is novel and original in theory or design. Illustrations of the complete engines and cuts of the details make the designs clear. An entire chapter is devoted to a comparative study of the principal elements of these engines; their points of similarity furnish the basis of a new critical discussion of the plans adopted by the best designers, in which the author gathers together technical information which will interest all designers and builders. Another chapter is devoted to the operation and maintenance of these engines, and is a clear statement of the system that should be followed in industrial establishments where they are used. Finally mention should be made of the author's list of applications of these engines for light and heavy work, and of his figures of their cost of operation. (Paris, E. Bernard; 1 rue de Médicis, 30 francs.)

Letters to the Editor.

Rock Excavation in Trenches.

Sir: It rarely happens that any two specifications agree on the subject of rock in trenches, yet it is such an important matter that some approach to uniformity would prove most agreeable to contractors. It is customary to require the trench to be a foot wider at the bottom and 6 in. deeper than the pipe, but all sorts of additional stipulations are also added. Where the contractor is paid by the cubic yard for this excavation, these additional clauses are often the cause of some worry. Theoretically the specifications are intended to explain the results required but when, by closely prescribing methods of conducting work and of preparing the estimates of quantities on which payment will be made, they sometimes approach nearer to directions to the contractor as to the way he shall do his work. It is my experience that this detailed direction is not always of service in securing good work at a low cost.

In the case of a trench, the bottom width is fixed by the diameter of the pipe to be laid in it. It is practically impossible to work in a trench much narrower than 3 ft. It is true that 2½-ft. trenches are sometimes dug but they are too narrow to work in. On the other hand, it is advisable to prevent so far as possible the excavation of a wider trench than is necessary. It seems to me, therefore, that the best specification is one providing for estimating rock trenches at least 2 ft. wider than the pipe and 6 in. lower. This does not absolutely require such excavation, in case the contractor is fortunate enough to encounter rock where clean walls are easily made, but it does pay him for the work he will really have to do in most cases. Any extra excavation, and there generally will be some, he ought to pay for himself, for its amount will depend on his methods of carrying on the work.

One advantage of such a specification is that it avoids any need of providing for a batter. It is true that few contractors have sufficiently heavy drills for making deep holes, so as to blast the full face of a deep rock trench at a single operation. If they have to take out the trench in two benches, with an attendant widening of the top width in order to give room for the drills in their lower position, there is no reason why the city should pay for this extra work. A deep blast hole, loaded with several charges separated about 5 ft. and fired simultaneously by electricity, will throw down a full face without blowing holes in the walls. Consequently, there is no practical reason for providing for a batter in rock trench specifications. For these reasons I would suggest the following specification for rock trenches: "All trenches in rock excavation shall be estimated 3 ft. wide for pipes 12 in. or smaller, and in other cases 2 ft. wider than the external diameter of the pipe and 6 in. below the bottom of the pipe."

Very truly, H. C. Goodwin.
New York.

Shear in Concrete.

Sir: In examining some of your American regulations concerning armored-concrete works, I notice what seems to be a very high value permitted for shearing stresses. This seems to be taken at about 50 lbs. per square inch by most of your engineers, and some even suggest a higher value. This is contrary to our views on this side, and I will be obliged if you will let me know whether any objections have been raised to th 50-lb. unit stress in the United States.

Permit me to point out that many years ago Bauschinger found that the ultimate shearing resistance of 2.4 x 4.8-in. beams of 1:3 mortar was only about 210 lb. and with beams a few weeks old was only about half this amount. Similar beams of 1:5 mortar averaged even less. These results were 20 per cent. greater than the ultimate tensile strengths determined at the same time, but they hardly warrant the use of 50 lb. as a unit working shearing stress. Mesnager and Feret in France have also made experiments which led them to assign higher values to shearing than tensile resistance. On the other hand, Tedesco and Christophe both hold a contrary view. The experiments made in England, with which I am familiar, have generally shown the ultimate shear of concrete made in the ordinary way to be under 150 lb. Consequently, I am desirous of learning whether you have made experiments which confirm the Feret tests or rely on them without such confirmation.

The shearing strength of concrete is becoming such an important engineering constant that it ought to be determined as closely as the tensile and compressive strengths. It is somewhat difficult to ascertain with even approximate accuracy, but if armored concrete formulas are to be more than a scientific sham, the determinations must be made. Shear is a most important factor in such composite beams, and I believe that it deserves far more experimental attention than it has received. My own belief is that careful tests of concrete of the character ordinarily used in works will show 25 lb. to be about as high as it is safe to allow for a unit stress.

Faithfully yours, Kenneth Graeme.
London, Sept. 26.

[Very few tests of the shearing resistance of concrete have been made in the United States. Prof. L. J. Johnson, who has made a careful study of the properties of concrete, is opposed to the use of so high a unit stress as 50 lb., while other engineers are satisfied with it.]

A Reinforced Concrete Highway Bridge.

A reinforced concrete highway bridge is to be built in connection with an overflow gravity section concrete dam that is being constructed to develop the water power of a stream at the municipal water works of Ithaca, N. Y. The dam replaces an old timber structure washed out last summer by a heavy storm. It will be 22 ft. high, 110 ft. long between abutments at the crest, and will conserve water to drive a hydro-electric generating installation in the water-works station, the generators furnishing power to run deep-well pumps. The dam site is a solid slate-rock formation into which the dam and its abutments will be keyed. The stream on which the dam is located is subject to sudden floods of considerable volume, so an unusually heavy cross section has been adopted. The bridge will have a 16-ft. roadway, extending longitudinally the length of the dam. It will have five 20-ft. reinforced concrete girder spans, resting on the end abutments and on concrete piers, 3 x 18 ft. in cross section, built up from the dam. The clearance between the bottom of the bridge and the crest of the dam is 10 ft., while the clear spillway length of the dam is 100 ft. The flat girder spans provide ample waterway between the bottom of the girders and the crest of the dam, without raising the roadway to an excessive height, as would have to be done to obtain the same amount of waterway with arches. The engineer of the work is Mr. C. C. Vermeule, of New York.

Stream Pollution by the refuse of a creamery which produces a condition actually destructive of physical comfort or health, or creating a tangible, visible injury to the property rights of a lower riparian proprietor, has been declared a nuisance by the Iowa Supreme Court, **100 N. W. Rep. 854.**

CURRENT NEWS SUPPLEMENT

OCTOBER 14, 1905.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

American Society of Civil Engineers. Secretary, Chas. Warren Hunt, 220 West 57th St., New York. Next meeting Oct. 18, paper on use of water for domestic purposes.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 95 Liberty St., New York.

National Fire Protection Association. Secretary, W. H. Merrill, Jr., Chicago.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John St., New York.

American Institute of Architects. Secretary, Glenn Brown, Washington, D. C.

Association of Engineering Societies. Secretary, Frederick Brooks, 31 Milk Street, Boston, Mass.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water St., New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

American Public Health Association. Secretary, Dr. C. O. Probst, Columbus, O.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Municipal Improvements. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Paterson, Concord, N. H.

American Railway Engineering and Maintenance of Way Association.. Secretary, L. C. Fritch, 1562 Monadnock Block, Chicago.

American Water-Works Association.. Secretary, J. M. Diven, Charleston, S. C.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

American Public Works Association. Secretary, W. H. Flint, Chattanooga.

Association of American Portland Cement Manufacturers. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

National Association of Manufacturers of Sand-Lime Products. Secretary, H. A. Duerr, Wilmington, Del. Next meeting, Dec. 5-7, Detroit.

National Association of Cement Users. President, Richard L. Humphrey, Harrison Building, Philadelphia, Pa.

THE NEW WATER SUPPLY FOR NEW YORK.

Abstract of Report of J. Waldo Smith, Chief Engineer, Board of Water Supply.

In compliance with your resolution of Aug. 9 approving a general plan for securing an additional supply of water from the Catskill Mountain region and directing the Chief Engineer to submit plans and additional information for securing water from this source, the following report is submitted:

The sources of supply in the Catskill Mountain region have been pointed out for so many years and by so many eminent engineers that there is now no room for doubt that they are the most quickly available, and both the best and the cheapest large sources that can be obtained under present conditions. The Housatonic is ruled out because of its location in the State of Connecticut and the delays that negotiations for its diversion, if found practicable, would entail. Ten Mile River, a tributary of the Housatonic, flowing into Connecticut, is also ruled out by the uncertainty of the law governing the diversion of interstate waters, and the watersheds adjoining the Croton on the north are ruled out by the prohibitions of the legislature in 1903-4.

In studying the Catskill sources, your Engineering Department has had the benefit of the results of careful investigations made in 1899-1900 of various water sources available for the supply of the City of New York, on record in the report of John R. Freeman, C. E., to the Finance Department of the City of New York, and in the report of the Merchants' Association, of similar date, but has been guided chiefly by the very full data found in the report of the Commission on Additional Water Supply (the so-called "Burr-Hering-Freeman Commission"), appointed by Mayor Low in 1902. The elaborate studies detailed at length in this report, published by the city in 1904, were carried on by a corps of engineers, experts and assistants, comprising in all about 200 men, who spent an entire working season in the field and very carefully studied the quality and feasibility of all available sources in the State of New York, excepting the interstate rivers.

The development of the Catskill sources now proposed was recommended by the Commission on Additional Water Supply, but as a step toward this, they contemplated the earlier development of the upstream half of the Fishkill and Wappinger watersheds as more quickly available and obtainable with smaller expenditure. In January, 1905, subsequent to the prohibition of the Dutchess County sources by the legislature of 1903-4, the same commission was reconvened by Mayor McClellan, and, after further study, recommended the Catskill Mountain sources without reserve as now the most available for a large future supply. Your attention is particularly directed to these two reports of the Burr-Hering-Freeman commission, and they are made a part of this report. Without the mass of information presented in these printed reports and the many survey maps on a larger scale made during these investigations and since turned over to the Engineer Department of your Board, by the Department of Water Supply, Gas and Electricity, it would have been impossible for your engineer to render a proper report at this early date.

In other independent investigations, the Catskill Mountain sources now recommended have been repeatedly pointed out and their merits discussed, notably in the investigations under the chief engineer of the Department of Water Supply, Gas and Electricity, of New York City, during the years 1902 and 1904. These are, moreover, the same sources from which the Ramapo Company, in 1899, proposed to supply the city, although under much less comprehensive plans and by far less efficient means.

Investigations of 1905.—Starting with the data contained on the plans, maps and reports above mentioned, and aided by the advice of members of the former commission and of certain engineers who were actively connected with the investigations above described, your Engineer made further investigations in the field, employing as large a force of experienced engineers as could be quickly engaged with proper observance of the Civil Service rules. This work has been directed principally toward locating an aqueduct line between the proposed Ashokan Reservoir and New York City, for although an aqueduct line between the same terminals had been very carefully studied by the former commission, the cutting out of the Dutchess County sources made it desirable to find a more direct line from the Ashokan Reservoir in the Catskill region down to the city. Fortunately the previous survey of the sites of the proposed reservoirs in the Catskill Mountains have been found sufficiently complete for the purposes of this report, with but a small amount of additional work. The aqueduct line suggested has all been reconnoitered in the field by engineers in the employ of your Board, and found feasible. It is, however, probable that closer study and more complete surveys will reveal here and there sections where the line can be improved or cheapened, or where some relatively small change of location will cause less disturbance to property owners.

Sources Now to be Considered.—The Commission on Additional Water Supply recommended that steps be taken at once toward the building of structures sufficient to gather, filter and convey to the city 500,000,000 gal. daily of water from the new sources, and that the construction of an aqueduct of the size appropriate to convey this quantity be started immediately. Whatever new data have come to hand, the investigations of that commission, relative to the rate of growth of the several Boroughs of Greater New York on which the above conclusion was based, tend only to emphasize this conclusion, and no reason appears for lessening the size of the aqueduct, although the sources in Dutchess County are withheld. Everything still points to the development of the new supply to the extent of at least 500,000,000 gal. daily by adding at least sufficient water from other sources to compensate for these Dutchess County streams, and the privision of the law of 1905 for the supply of other municipalities along the line of the aqueduct tends also to forbid any diminution of the size of the works, and as the details of the work are studied it may be perhaps found advisable to increase somewhat this size. There are sources within the Catskill Mountains which, combined, are sufficient to supply even more than 500,000,000 gal. per day.

Your engineer, after conferences with the consulting engineers, recommends that the new main aqueduct be continued all the way from the main distributing reservoir at Hill View, up to the Ashokan Reservoir, of a suitable size for the delivery therefrom, of a mean annual quantity equivalent to at least 500,000,000 gal. daily, and that as provided in chapter 723 of the laws of 1905, immediate application be made to the State Water Supply Commission for the appropriation of the water of the following named sources for the supply of the City of New York, viz.:

1. Esopus Creek, to be taken at a point near Olive Bridge.
2. Rondout Creek, to be taken at a point near Napanoch; three small streams tributary to the Rondout.
3. Schoharie Creek, to be taken at a point near Prattsville.
4. Catskill Creek, to be taken at a point about 1 mile north of East Durham. Six small streams tributary to aqueduct from Catskill Creek to Ashokan Reservoir.

The estimated yield of these sources, under most favorable conditions of development, with dams, reservoirs and connecting tunnels, all of the largest reasonable size so that the impounding and storing of flood waters may be of the greatest practicable extent, is stated in the accompanying table. But it should be remembered that these estimates while carefully made are in part based on observations of rainfall and stream gagings within this region covering less than a single year.

From reconnaisance surveys and for purpose of estimating cost it appears best to make the high water level of this reservoir 600 ft. above tide. Further investigations with borings and test pits at dam sites may demonstrate an elevation of 590 ft. as sufficient and more readily feasible.

Estimated Yield in Gallons per Day of Proposed Sources.

Esopus Watershed, area 255 square miles, with storage near outlet of about 70 billion gallons	250,000,000
Rondout watershed, area 131 square miles, with storage, in three reservoirs, of about 20 billion gallons	98,000,000
Three small watersheds tributary to Rondout, area 45 square miles	27,000,000
Schoharie watershed, area 228 square miles, with storage, partly in Ashokan Reservoir, of about 45 billion gallons	136,000,000
Catskill watershed, area 163 square miles, with storage partly in Ashokan Reservoir, of about 30 billion gallons	100,000,000
Six small watersheds, tributary to aqueduct between Catskill Creek and Ashokan Reservoir, combined area about 82 square miles	49,000,000
Total available yield of the Catskill sources exclusive of (interstate) Delaware tributaries	660,000,000

While the yield of the Esopus watershed was investigated with much detail by the Commission on Additional Water Supply, and several reservoir sites on the Esopus were studied, the studies of the maximum amounts of storage that can be reasonably developed on the Rondout, Schoharie and Catskill watersheds were not made in great detail because of lack of time and funds. The above estimates of yield of these several watersheds are conditioned on storage reservoir construction and each is subject to revision. But from the surveys already made it is certain that the sources named above are sufficient to supply fully 500,000,000 gals. daily, and with present rate of growth and use continued it is certain that New York City will within 25 years need substantially all the water that these sources can supply in years of extremely low rainfall.

It is proposed to construct at first only the great Ashokan Reservoir and to build this of the largest practicable size, deferring the expenditure on development of the other sources until such date as the growth of the city will demand them. Economy requires that the portions of the aqueduct that are of masonry or in tunnel be constructed of full size from the start, and that it all be located with reference to the successsive additions of the other sources. Therefore, a comprehensive plan for the development of all the Catskill sources mentioned above must be provided for at the present time.

Now that it has been prescribed by law that the Fishkill and Wappinger and Jansen Kills are not to be diverted, more complete surveys of the Rondout, Schoharie and Catskill will be soon undertaken by your engineering department. The prohibition of more than a single reservoir on the Esopus (section 3, chapter 724, laws of 1905), also the early requirement of connection to the Schoharie and Catskill watersheds, render it desirable that the Ashokan Reservoir be of the largest practicable capacity.

Rye and Kensico Reservoir.—The elimination of the Wappinger and Fishkill sources, the consequent more direct line permitted for the aqueduct from the Ashokan Reservoir to the city and the greater length of aqueduct between equalizing reservoirs, also rendered necessary by these changes from the plans of the Commission on Additional Water Supply of 1902-3, causes a new location to be sought for the future filtration works, and makes desirable the use of Rye Pond for an equalizing storage reservoir at the downstream end of the main aqueduct, much as was contemplated in the plans of G. W. Birdsall, chief engineer of the Department of Water Supply, Gas and Electricity, presented in 1904.

The availability of Rye Pond and Kensico Reservoir for enlargement into a great equalizing reservoir has long been appreciated. It formed an important part of a plan for developing the Ten Mile watershed for the supply of Brooklyn, made in 1895. It was also favorably considered in the report of John R. Freeman, civil engineer, to the Finance Department, in 1900, and the building of a great equalizing reservoir at this point has been recently given further study by your engineering corps. This site certainly has natural advantages possessed by no other for the building of a great reservoir on the line of the aqueduct sufficient to supply the city for many days in such emergency as an accident anywhere along the 69 miles of aqueduct intervening between this point and the Ashokan Reservoir, and thus making it safe to rely on a single aqueduct for the entire Catskill supply. This large storage would also be of great value in permitting the water to be shut out of the main aqueduct for a week or more at a time for the purpose of inspection, repair and thorough cleaning. These studies so far as completed, show that the best and most reasonable development of storage for this purpose can be made by a dam located near the present Kensico dam of the New York Department of Water Supply, Gas and Electricity, but much higher, so that the water line of the proposed reservoir will be about 355 feet above mean tide. This would form a reservoir of about 3.60 square miles area, containing 25 billion gallons, or 50 days' supply at 500 million gallons daily, available for draft above the inlet to the aqueduct leading to the several boroughs. A suitable site for a filtration plant of 500 million gallons daily capacity has been found near Scarsdale, about four miles south from Kensico Reservoir.

Portions to be First Built.—A consideration of the fortunate excess of capacity in the present Croton aqueducts above the yield of the Croton watershed in a dry year is important at this time in planning the portions of the work to be first begun and first completed.

The "New" Croton aqueduct, completed 15 years ago, when running at its full capacity, can, in its present condition, deliver 295,000,000 gal. per day. The "Old" Croton aqueduct, as now being repaired, can be relied on to convey about 80,000,000 gal., or both together will convey about 375,000,000 gal. It is probable that, by making some structural changes in the line of the new aqueduct, so that it could be run under the full pressure corresponding to the level in Croton Lake, it could be made to convey a still larger quantity. In years of extreme drought, the Croton watershed with all present reservoirs, including the great new reservoir now nearing completion, although every reservoir should be drawn to the bottom, can be prudently relied on to yield not more than 300,000,000 gal. daily. This safe yield cannot be increased by the construction of additional reservoirs in the Croton Valley to much in excess of 325,000,000 gal.

The consumption of Croton water has already averaged for an entire month 318,000,000 gal. daily, and for a year 292,000,000 gal. For ten years past, the increase has been at the average rate of 14,000,000 gal. daily. Obviously, therefore, if the new large Catskill Mountain sources can be made available and an aqueduct completed thence down to the edge of the Croton watershed, a sufficient quantity to relieve the immediate danger of water famine can be taken down Croton Lake and through the two existing Croton aqueducts. Hence, in constructing the aqueduct, attention should be first given to that portion lying between the Ashokan Reservoir and the Croton watershed, aggregating 54 miles in length.

Hudson River Crossing.—The crossing of the Hudson River by the 500 million gallon aqueduct is one of the most important matters for immediate consideration, and borings were begun recently to determine the character of sub-strata at the point where the surface indications give the greatest promise of favorable conditions. The work of boring is now in progress. Studies on the surface of the ground have indicated that it will be feasible to locate this crossing near the village of New Hamburg. Either one of several types of river crossing may be made, according to the character of the bed of the river revealed by the borings.

Hill View Reservoir.—A reservoir at this point was strongly recommended in the report of John R. Freeman, C. E., to the Finance Department in 1900. The engineers of the Merchants' Association, in 1899 and 1900, arrived at a similar conclusion. This site was again recommended in the report of the Burr-Hering-Freeman Commission, in 1903, and definite plans for its development and the type of construction to be employed were presented in that report. While the construction of a great reservoir at Rye and Kensico, as now recommended, will permit a smaller expenditure at Hill View in the immediate future, it is the belief of your engineer that the entire Hill View site, as contemplated by the reports above mentioned, comprising in all about 325 acres and the site for the filtration plant near Scarsdale should be immediately secured.

Connections to Distribution System.—Since evidently the matter of first importance is to secure the most available sources of supply and to plan the more difficult portions of the aqueduct for bringing this water to the city, and particularly to design those portions of the work which will require the longest time for their construction, but little opportunity has yet been found for planning these several lines of distributing aqueducts or conduits for delivering the new supply to the several boroughs. It is obvious from a study of the map and from the inspection of the ground already made by the engineers of your Board, that these distributing lines present no uncommon difficulties. A tunnel of 200,000,000 gals., daily capacity, across the East River with a connection suitable for delivering 100 million gallons daily to Brooklyn has been in part studied out. A line suitable for delivery of about 20 million gals. to Staten Island by way of Brooklyn has also been reconnoitered. It is possible that studies made more in detail will indicate some modification of this line to be advisable, and the precise form, dimensions and locations best adapted for the proposed terminal reservoirs of the aqueduct system in Brooklyn and on Staten Island remain as subjects for further study. The main distributing lines from Hill View Reservoir to the Boroughs of Manhattan, Queens and The Bronx are matters for later consideration.

Special Needs of Brooklyn.—With the legal restrictions and the limitations that surround large construction work for the City of New York, it now appears probable that even with the most vigorous and the most rapid progress from five to eight years must elapse before water from the new source can be delivered into Croton Lake and thence to Manhattan, Brooklyn and the other boroughs. Although the boroughs of Manhattan and The Bronx, being more directly on the line of the aqueduct that will end in Brooklyn and Richmond, will, therefore, be naturally the first to be benefited, it must be recognized that the present needs of Brooklyn are even more pressing than the needs of Manhattan, and they have, therefore, already engaged the attention of your engineers. The water shortage in Brooklyn during the past season is almost without precedent in the history of a large American city. The consumption so outran the supply that there were hours in the day and even days at a time when houses on upper levels are said to have been deprived of a public water supply. In the course of this shortage resort was of necessity had to the throttling of gate valves in street distributing pipe to lessen the pressure and choke the draft, so that in many parts of the city water could not be drawn in the upper stories of dwellings during the working hours of the day. This throttling of water gates invites a conflagration hazard which is not pleasant to dwell upon.

From the investigations and report of the Burr-Hering-Freeman Commission, it appears plain that if the present rate of increase in consumption continues, Brooklyn cannot be properly asked to wait for the new supply from the north.

From the studies of the ground water supply presented in the report of John R. Freeman, C. E., to Bird S. Coler, Comptroller in the year 1900, and particularly from the more elaborate investigation of the Long Island underground sources made by the Burr-Hering-Freeman Commission, it is plain that the additional sources most quickly available for relieving the great need of Brooklyn for more water, are to be found on Long Island, and no effort should be spared to make all those sources available. Nevertheless, Brooklyn must also be in part supplied from the Catskill sources, and, as already mentioned, a branch aqueduct for this purpose is proposed.

Your engineering department has already begun studies directed toward the further exploration of the deep underground sources of Long Island, and, purely as a matter of obvious and prompt relief as well as of good engineering, regardless of present legislative limitations, feels it incumbent as a matter of engineering to record the fact that while Brooklyn should be given connections to the new supply from the north with all possible promptness, this relief is probably eight years off, and that its quickest and cheapest source of relief is in the ground waters of Long Island—particularly those of the region farther to the east than that yet drawn upon for the city supply. From those more easterly sources a large surplus that now runs to waste into the sea could be taken for the use of Brooklyn, Queens and Richmond without real injury to the local communities, and it would for a long future remain one of the cheapest and purest sources, too valuable to be disregarded, even after water from the Catskill sources is delivered to Brooklyn and Queens.

Fortunately, the structures required for securing this ground water and delivering it into Brooklyn are of a simple character, permitting very rapid construction and therefore early relief, providing existing complications can be met and overcome.

Borough of Richmond.—Purely as an engineering problem, the cheapest and most available source for relieving the urgent needs of the Borough of Richmond would be water from New Jersey, but with this withheld by questions of interstate law, recourse must be had to bringing the water across from the Borough of Brooklyn in a deep tunnel or submerged pipes, while on land the conduit would consist of a single 48-in. main laid in the streets diverging from the end of the tunnel under the East River. On favorable high ground on Staten Island a terminal reservoir would be built, giving sufficient storage to tide over an accident. The needs of Staten Island require that this terminal reservoir and a portion of this conduit should be constructed in the near future sufficient to connect with the distribution mains of the present or prospective ground water supply to Brooklyn, thus bringing relief several years earlier than the completion of the aqueduct from the Catskills.

Urgency for Rapid Progress.—It is unnecessary to dwell at this time on the necessity of an additional supply except for the purpose of emphasizing its great urgency and the danger that the city incurs from a water famine in the years intervening before any large new supply can be delivered. This great urgency demands a most vigorous prosecution of the work and calls for a more elaborate organization, with department engineers who should be men of larger experience and higher skill for separate branches of the work, than would perhaps be called for if it were allowable to carry on the work of construction in this wide range of territory with greater deliberation. Each main division of this work extending over 140 miles of territory, from the head of the Ashokan Reservoir to the terminal reservoir on Staten Island, requires the undivided attention of an engineer capable of deciding important questions in the field and meeting many emergencies as they arise. With proper organization, the most vigorous and rapid prosecution of the work need add but little to its cost, and, indeed, it is possible there may be on the whole a saving due to lessening the interest charges on the expenditure during the period of construction before the structures are put into use.

The estimated cost of constructing the Ashokan Reservoir and an aqueduct of 500 million gallons daily capacity from this point to Hill View Reservoir, including the Rye Pond Development, together with a conduit of 100 million gallons daily capacity from Hill View Reservoir to Brooklyn, with terminals at Forest Park, and a pipe line of 20 million gallons daily capacity to the Borough of Richmond, is $112,092,000. This will ensure the delivery of 250 million gallons per day to Hill View, of which 100 million gallons per day will go to the Boroughs of Brooklyn and Richmond.

The additional 250 million gallons daily necessary to provide the full capacity of the aqueduct, will be furnished later from Rondout, Schoharie, and possibly also the Catskill watersheds at an additional expenditure, including filtration, of about $49,765,000.

SEPTIC TANK LITIGATION.

The case of the Cameron Septic Tank Co. against the village of Saratoga Springs, N. Y., has reached that point at which the defendants have completed their case. It will be remembered that in this case the western cities of Madison, Wis., Monmouth and Lake Forest, Ill., and the Allis-Chalmers Co. have joined with Saratoga Springs in testing the validity of the Cameron Company's patents. The case comes up in the Second Judiciary Circuit, and hearings have been held before a master in New York City and in Chicago.

Testimony for the defendant cities has been given by Mr. F. Herbert Snow, who reviewed the history of the art in a very comprehensive manner. Cases of alleged intentional prior use have been testified to by Mr. William S. MacHarg, consulting engineer of the Sewer Department of Chicago, Prof. A. N. Talbot, of the University of Illinois, and Mr. Benezette Williams, of Chicago, who was formerly associated with the late Col. George E. Waring. A final review of these alleged prior users, and the history of the art, with application of the clauses in the Cameron patent to the alleged prior users cited, has been made in the testimony of Mr. John W. Alvord, of Chicago. A number of minor witnesses have been heard to substantiate the claims of prior use, and the record for the defense has thus been closed.

The plaintiffs now have the opportunity of rebuttal, and hearings for this purpose will soon take place, probably in both New York and Chicago. Every effort is being made by both parties to expedite the matter so that a decision may be arrived at in the near future.

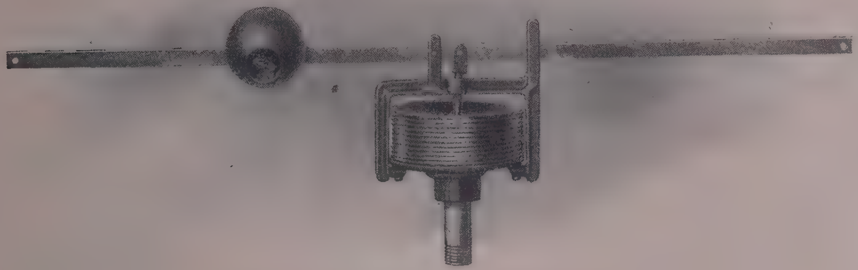
A booklet on coal mining machinery, published by the Ingersoll-Sergeant Drill Co., 11 Broadway, explains briefly the uses of the New Ingersoll coal cutter, Radialaxe coal cutter, Haeseler coal boring machine, Little Jap hammer drill, standard drills and compressors and pneumatic displacement pumps.

A NEW DAMPER REGULATOR FOR STEAM BOILERS.

This improved regulator, recently put on the market by the American Radiator Co., is designed to produce an extra sensitive, reliable and durable device to control the draft dampers of steam boilers. Its value as a permanently automatic regulator of combustion has been abundantly proven by an exhaustive series of practical tests covering an extended period.

The regulating device is made upon the bellows plan and is formed of two brass discs with accordion sides, made of steam brass of the best quality. The accordion sides are formed of ten deep folds which permit of ample yet very sensitive expansive effect upon the vertical rod that connects the top of the bellows to the bar upon which the counterbalance weight is placed. It readily expands and contracts with the variation of steam pressure. The sides are not built up of separate dics, but are formed from a single piece of brass so that there are no joints or seams to come loose and cause leakage. The top of the bellows is an inflexible brass disc and the action of this disc is governed by the pressure of the steam under it operating to expand or contract the folds of the sensitive brass sides. The top and bottom discs of the bellows are made of brass pressed into concave shape to make them absolutely inflexible.

It is thoroughly tested by expanding and contracting the bellows by means of a testing machine producing a number of rapid strokes and then subjecting it to hydraulic pressure. Careful provision is made both for elastic movement and for tensile strength in all the parts. While the regulators which the company furnishes with its boilers are unsurpassed by any of their kind, this regulator is an improvement designed for extra fine adjustment. The ordinary regulator is operated by a rubber diaphragm placed inside the steam box and the steam pressure operating on this rubber sheet lifts the plunger which is attached to the bar. The initial energy exerted by the steam pressure must be expended in moving this rubber sheet, which offers no little resistance because of its concaved position in the box. In the new regulator the action is direct and instant, the slightest change in pressure operating on the bellows-top and instantly communicating to the regulator bar the exact degree of expansion or contraction of the bellows. It works just below atmospheric pressure, closing the dampers before one ounce of steam pressure is generated, if desired. By shifting the counterpoise weight one can change its application from below atmospheric pressure to any pressure desired and maintain good draft control. These facts have been well established in connection with this regulator by means of a mercury column which records readings in half ounces and its sensitiveness has been thereby thoroughly proven.



NEW DAMPER REGULATOR FOR STEAM BOILERS.

The bellows is fed by a 1-in. opening in the bottom plate of the bellows, which is 5¾ in. in diameter and 2¼ in. high, at rest. The lever is 37 in. long. The complete regulator weighs only 10½ lb., including bar and weight.

THE IRON AND STEEL SITUATION.

The returns made to the "Iron Age" from blast furnaces show that production in September, in spite of the fact that it was a short month, was 1,898,873 gross tons, as compared with 1,843,673 gross tons in August and 1,741,935 tons in July. Returns from all the steel companies make their pig iron product 1,262,033 tons in September, against 1,186,050 tons in August, an increase in spite of the fact that the Pittsburg district produced only 449,632 tons in September as compared with 488,119 tons in August. The returns indicate that the merchant furnaces did not do as well in September as expected, their production having been 657,623 tons, while they made 636,840 tons in August. The capacity at work has increased in September and stood on Oct. 1 at 445,468 tons a week, as contrasted with 412,563 tons on Sept. 1.

There is the promise, therefore, of an increased production which the country needs so sorely. There has been a good deal of buoyancy in the pig iron markets in all parts of the country and prices have been further advanced. A growing number of furnaces hesitate about committing themselves heavily for the future, in view of the considerable rise in costs. Some of the large foundry interests have bought quite heavily. In the West the International Harvester Co. has purchased between 45,000 and 50,000 tons, 20,000 tons from an Alabama interest, 7,000 tons from Virginia producers and the balance from Northern furnaces. Three cast iron pipe concerns have taken very close to 50,000 tons among them, and there has been some very good buying by the general foundry trade, a Pittsburg melter taking 11,000 tons. Quite a number of Eastern open hearth plants are negotiating for additional quantities of basic iron, one of them being in the market for 1,200 tons and the others for somewhat smaller lots. While the buying of Bessemer and basic iron in the Central West has been rather light in the last week, it is known that two large steel interests are figuring on the purchase of some large blocks for the first six months of next year.

Some further goodly orders have come to rail mills, including 45,000 tons additional from the Northern Pacific, 35,000 tons from the Great Northern, 29,000 tons from the Minneapolis and St. Louis and 13,000 tons from the Kansas City, Mexico and Orient. Manufacturers of frogs and switches have ordered between 10,000 and 12,000 tons, and it is reported that one of them has been forced to place a small order for girder rails abroad.

CARTHAGE LIMESTONE.

Architects and engineers who are acquainted with the merits of the limestone found at Carthage, Mo., will be glad to know that arrangements have been made for placing it on the market in large quantities. The chemical analysis of the stone shows its exceptional purity and is as follows: Calcium carbonate, 99.27 per cent.; magnesium carbonate, 0.6 per cent.; aluminum and iron, 0.18 per cent.; insoluble matters, 0.63 per cent. The results of physical tests made in the laboratory of the State Geologist of Missouri are equally interesting. The porosity was found to be 1.34 per cent., the ratio of absorption ½ of 1 per cent., and the crushing strength 20,000 lb. per square inch. The maximum modulus of rupture in transverse tests was 2,916. It was found that there was a loss in weight of only 0.17 per cent. after 33 alternations of freezing and thawing. The specific gravity averages 2.708. The average weight of the dry stone is 167 lb. per cubic foot, but in ordinary commercial work it is assumed to be 200 lb.

As a building material the stone has a great advantage on account of its pure white color. Owing to its good physical properties, mentioned above, it resists deterioration, and its non-absorption of water enables any dirt to be washed off readily. The same property also prevents staining by colored mortar.

The stone is now being quarried and marketed in many forms by the Carthage Superior Limestone Co., which has installed a large plant for working up all parts of the quarry product, thus ensuring very low charges for the dimension stone for bridges, buildings and monuments. The smaller material is crushed for macadam and for other purposes, the finest product passing a 200-mesh screen. The equipment of the company includes channelers, drills and a compressed air plant for getting out the stone, a sawmill with a capacity of over 1,000 cu. ft. of stone daily, and an electrically driven crushing plant of 200 tons capacity per day. This latter is located about a thousand feet from the mill and contains a crusher and two pulverizing rolls.

The power equipment includes a boiler plant of 175 h.-p. capacity, two engines of 150 h.-p. combined capacity, and a 50-kw. generator. The entire plant is designed on a duplicate system, even to the water supply, so that a shut-down from accident is unlikely. As the works are operated nights a complete independent lighting plant has been installed. The company's property comprises about 24 acres and is reached by two spur tracks 1,100 ft. long.

BUSINESS NOTES.

The Narragansett Bay coaling station built by Mr. Augustus Smith, of New York, for the U. S. Navy, was formally tested on Oct. 7, in the presence of Rear Admiral Manney, Commander Nelson and other officers. The plant was required to have an in-going capacity of 100 tons per hour and an out-going capacity of 200 tons, and exceeded these requirements about 20 per cent. The Mead-Morrison coal-handling system is used. The capacity of the plant was recently increased to 40,000 tons, and is now in charge of Mr. R. I. Bakenhus, civil engineer, U. S. N.

The Havana Mfg. Co., Havana, Ill., has succeeded to the business of the Ashurst Press Drill Co., and has improved and increased the old facilities for handling the business. The company makes the "Red and Ready" and "Havana" line of gas and gasoline engines and the Havana double-grip friction clutch pulley.

The Robins Conveying Belt Co., 21 Park Row, New York, has recently secured through J. G. White & Co., a contract for the belt conveyors for the naval coaling station at Olongapo, P. I. The company is now constructing a belt conveyor for handling coal at the Buffalo plant of the Lackawanna Steel Co., and expects to ship shortly a large order of belt conveyors for the Santanda iron mines at Santanda, Spain.

PERSONAL NOTES.

Mr. Clarence M. Du Bois, of New Brunswick, N. J., has joined the Isthmian Canal Commission's staff as assistant engineer.

Capt. Charles H. McKinstry, Corps of Engineers, U. S. A., has been ordered to Los Angeles to relieve Col. Wm. H. Heuer.

Mr. F. M. Langridge has been appointed professor of mechanical engineering at the Colorado Agricultural College at Fort Collins, Colo.

Mr. Samuel D. Brady has been appointed chief engineer of the Marietta, Columbus & Cleveland R. R., with headquarters at Marietta, Ohio.

Mr. Samuel Rea has been elected third vice-president of the Pennsylvania R. R. Co., but will remain in charge of all construction work.

Mr. Oscar E. Thompson, of Phoenixville, has been appointed engineer of a State bridge to be built over the Lycoming Creek near Williamsport, Pa.

Mr. John W. Kendrick has been elected second vice-president of the Atchison, Topeka & Santa Fe Ry. He will be in charge of operations, as before.

Mr. Henry E. Riggs, of the Toledo engineering firm of Riggs & Sherman, has been retained as chief engineer by the Marion, Bluffton & Eastern R. R. Co.

Mr. T. A. Eide has resigned as assistant engineer of the Oregon Short Line R. R. at Pocatello, Idaho, and joined the engineering staff of the New York Central & Hudson River R. R.

Mr. R. S. Fowler, assistant engineer of the Rapid Transit Subway Construction Co., of New York City, has resigned to become assistant engineer on the Pennsylvania, New York & Long Island R. R.

Mr. A. M. Jones will have charge of the construction of the first section of the Grand Trunk Pacific Ry. He will rank as assistant engineer and have his headquarters at Portage La Prairie, Man.

Mr. J. J. Brown, manager of the centrifugal pump department of the International Steam Pump Co., sailed recently for northern South America where he will remain for several months in the interest of his company.

Mr. K. B. Thornton, operating manager of J. G. White & Co., has been appointed manager of the Nassau Light & Power Co., at Roslyn, N. Y. This company is managed and operated by J. G. White & Co.

Mr. M. J. Brayton, general manager of the electrical department of the Utica Gas & Electric Co., has been appointed secretary of the company and will be succeeded as department chief by Mr. C. A. Greenidge.

Mr. J. W. Leonard, superintendent of construction of the Toronto-Sudbury branch of the Canadian Pacific Ry., has been appointed assistant general manager of the company's lines east of Fort William, with headquarters at Montreal.

Mr. W. W. Seddon has been promoted to the office of chief engineer of the Seaboard Air Line, at Portsmouth, Va. His predecessor, Mr. W. W. Gwathmey, Jr., resigned to engage in general engineering and contracting in Norfolk.

Mr. George R. Bascom has become connected with the Chicago office of Mr. John A. Cole, consulting engineer. Mr. B. B. Hodgman, of Mr. Cole's office in New York, and Mr. Bascom are making preliminary water measurements with the pitometer in Philadelphia.

Mr. Alexander Potter, of New York, consulting engineer of the Joint Sewerage Commission of numerous

New Jersey towns and cities, read a paper before the Sanitary Section of the Boston Society of Civil Engineers last week, on breakages in sewer conduits, their cause, effect and prevention.

Prof. Albert S. Richey was recently given a gold watch and chain and Mrs. Richey was given several pieces of silver by the employes of the engineering department of the Union Traction Co. Prof. Richey recently resigned the position of chief engineer of the company to take charge of the course in electric railway subjects at the Worcester Polytechnic Institute.

The announcement that Secretary Taft will remain in charge of the Panama canal affairs is welcome news. If the work is to be done, stable management is necessary. Secretary Taft is one of the best administrative officials the country has had for many years, and his knowledge of canal affairs is already so great that it would have been a misfortune had the Commission been transferred from his department.

Mr. Henry R. Buck, assistant city engineer of Hartford, has been appointed chief engineer of the Connecticut Boundary Commission. The Commission consists of Governor Henry Roberts, Attorney-General W. A. King, and Mr. Frank G. Sumner, of Hartford. It will cooperate with a similar Massachusetts body in a resurvey of the boundary between the two States. Mr. Buck was graduated from the Sheffield Scientific School in 1896, and has ever since been with the Hartford engineering department.

A social organization known as the San Francisco Engineering Club is being formed in that city. The purpose is to have club quarters for civil, electrical, mechanical and mining engineers, chemists, architects, builders and contractors, managers of industrial works and representatives of machinery houses. The committee in charge of the preliminary organization consists of L. E. Sperry, California Electrical Works; E. B. Parsons, Kilbourne & Clark Co.; T. E. Bibbins, General Electric Co.; C. L. Cory, Union Trust Bldg.; A. C. Roulfson, A. C. Roulfson & Co.; George P. Low, Crossley Bldg., and C. E. Wiggin, Electrical Contractors' Association.

George W. Catt, president of the Atlantic, Gulf & Pacific Co., died at his home in New York, on Oct. 8. He was one of the most successful engineering contractors in the country. He was born in Davenport, Ia., in 1860, and was graduated from the Iowa State College. For many years he was engaged almost exclusively on the Pacific Coast in dredging work and bridge building. Some of his early dredges of the ladder type were remarkably good machines for their date, and his early utilization of hydraulic dredges did much to demonstrate their value. He came to New York about fifteen years ago and gradually built up the organization now known as the Atlantic, Gulf & Pacific Co. Although Mr. Catt was an unusually good engineer and was interested in engineering subjects and societies, his business obligations were so numerous and onerous that he never won the professional reputation he deserved.

Mr. W. L. Darling has resigned the office of chief engineer of the Chicago, Rock Island & Pacific Ry., which he has held since August, 1903. He graduated from the Worcester Polytechnic Institute in 1877, four years after his long-time chief, Mr. John W. Kendrick. He entered the service of the Northern Pacific R. R. in 1879 as resident and locating engineer, and in 1883 became resident engineer on the St. Paul & Northern Pacific Ry. The next year he served as locating engineer on the Burlington and the Florida lines, and then, in August, 1887, was appointed engineer in charge of terminals of the Chicago, Burlington & Northern R. R. In 1887 he was chief engineer of the Duluth, Watertown & Pacific R. R., a position he left to become assistant engineer on the St. Paul, Minneapolis & Manitoba Ry. In January, 1889, he became assistant engineer of the Northern Pacific R. R. and gradually rose to the office of chief engineer, which he held until he joined the Rock Island system.

Mr. John Lyman Faxon, the well-known Boston architect, has recently established a New York office at 170 Fifth Ave., where he will spend a considerable part of his time. This announcement is particularly interesting because he will be one of the few representatives of what may be called the financial school of architecture. For a number of years he has been paying special attention to the structural features and the mechanical equipment of buildings. There are many property owners who desire architectural advice concerning buildings as investments rather than works of art. They desire structures containing the maximum amount of reliable space at the least expense consistent with sound construction, and Mr. Faxon has built up a large advisory practice in Boston along these lines. It is only just to add, however, that some notably attractive structures have been planned in his office. The First Congregational Church at Detroit, called the "cathedral church" of Michigan, is one of his buildings, and another is the East Boston High School, which has been frequently termed one of the finest examples of high-school architecture, artistically, structurally and mechanically, to be seen in any country. Its mechanical equipment was described in this journal shortly after the school was opened.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

WATER.

Notes Arranged Alphabetically by States.

Yuma, Ariz.—See "Schools."

Benson, Ariz.—See "Power Plants, Gas and Electricity."

Santa Ana, Cal.—The Villa Park Water Co. is reported incorporated, with J. P. Williams, Wm. Bathgate and E. I. Stanley as directors; capital, $4,400.

Lemon Grove, Cal.—C. E. Bailey, Secy. Lemon Grove Mutual Water Co., writes that the company purposes to connect the town with the main water supply of San Diego County, by laying about 18,000 ft. of 10-in. pipe. Engineer, W. M. Rumsey, of San Diego.

Cripple Creek, Colo.—T. H. Devine and John F, Vaile, of Pueblo, are reported interested in the construction of a dam to impound all the flood waters on West Beaver Creek in Teller County, to cost about $200,000.

Waterbury, Conn.—It is stated that bids will be received until Oct. 17 by the Bd. Pub. Wks. for laying water mains in Aurora St. and part of Bunker Hill Road. R. A. Cairns, City Engr.

**Danbury, Conn.*—A. L. Davis, City Engr., writes that the contract for furnishing material and constructing a reservoir dam, forebay and pipe line (bids opened Sept. 25) has been awarded to Peter Sweeney, 26 Montgomery St., Danbury, for $105,531. For list of detail bids received for the work, see issue of The Engineering Record Oct. 7.

East Hartford, Conn.—The East Hartford Fire Dist. is reported to be considering the question of increasing its water supply, by taking water from Salmon Brook in Glastonbury, and erecting on Mr. Strickland's land a dam and spillway, thereby creating a reservoir or settling basin, and then connecting the reservoir by a 12-in. pipe with a distributing well on the land of the Fire Dist.

Mayo, Fla.—See "Power Plants, Gas and Electricity."

Pensacola, Fla.—Bids will be received until Oct. 31 at the Bureau Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing material and driving test wells at the Navy Yard, Pensacola. H. T. B. Harris; Paymaster Gen., U. S. N.

Jacksonville, Fla.—Philip Priolean, City Engr., writes that the citizens voted Oct. 3 to issue $400,000 bonds for municipal improvements. According to local press reports, the money will be expended for the extension of water mains, sewers and drains and street improvements.

Ft. Screven, Ga.—Capt. J. T. Davidson, Corps Engrs., U. S. A., writes that bids for pumphouse and machinery (opened on Sept. 29) have been rejected and new bids will be received.

*The contract for sinking two 6-in. wells at this post (bids opened Sept. 29) has been awarded to O. E. Hughes & Co., of Charleston, S. C.

Griffin, Ga.—This city will build an impounding reservoir and put in a filter plant. Engineer, Nisbet Wingfield, Augusta.

Ocilla, Ga.—See "Power Plants, Gas and Electricity."

**Chicago, Ill.*—The U. S. Cast Iron Pipe & Fdy. Co., of New York, N. Y., has secured the contract for furnishing 221 pieces of 36-in. c.-i. pipe, at $26.40 per ton, and 336 pieces 16-in. c.-i. pipe at $24.98 per ton (bids opened Sept. 30.).

*J. G. O'Neil, Rookery Bldg., has secured the contract for four 250-hp. boilers for Lake View pumping station (bids opened Oct. 4) for $47,126.

Comr. of Pub. Wks. J. M. Patterson is reported to have directed Wm. H. McCard, Consulting Engr., to plan the complete reconstruction of the water works in conjunction with City Engr. Ericson.

**Waukegan, Ill.*—M. R. Miller, Supt. Pub. Wks., writes that contracts for water mains (bids opened Sept. 29) have been awarded as follows: J. M. Healy, of Chicago, for 3,871 ft. 8-in. pipe on N. Butrick St., $4,577, and 3,200 ft. 6-in. in Washburn Springs Dist., $2,993. To L. M. McDonaugh, of Waukegan, for 1,993 ft. 6-in. pipe on Grand Ave., for $1,929; and to H. C. Patterson, of Waukegan, for 1,052 ft. 6-in. pipe on S. West and Kennard Sts., for $1,117.

Arlington Heights, Ill.—It is reported that new bids are to be received until Oct. 18 by the Bd. Trus. (Henry C. Klehm, Pres.) for extending the waterworks system. H. L. Emerson, Engr., Chicago, Ill.

Libertyville, Ill.—The following are the bids opened on Oct. 5 by the Bd. of Local Improv. for water supply pipe, to consist of 3,050 ft. 8-in. water pipe, 28,650 ft. 6-in., 612 ft. 4-in., and 51 hydrants: (Engineer, Jas. Anderson, Jr., Lake Forest): F. F. Mortimer, Glencoe, $28,305; C. M. Porter, 84 La Salle St., Chicago, Ill., $29,574, C. E. Russell, Waukegan, $31,570; E. M. Laing, Highland Park, $28,051; C. F. Bartlett, Evanston, $33,509; W. J. Allan, Waukegan, $29,715; L. McDonough, Waukegan. $33,129; P. R. Fletcher, Blue Island, $28,469, and McNicholas & Cogan, 84 La Salle St., Chicago, $27,929..

Ft. Wayne, Ind.—Danl. W. Mead, of Chicago, Ill., is reported to have completed plans for a new reservoir at the north side station and for enlarging and extending the delivery system on the west side; probable cost of work, $70,000 to $80,000.

Brazil, Ind.—City Engr. Fletcher is reported to have been authorized to prepare plans and specifications for a sealed water gallery for the water works; it will be 140 ft. long, 40 ft. wide, 15 ft. deep and have a capacity of 630,000 gals.; estimated cost, $3,000.

Scottsburg, Ind.—See "Power Plants, Gas and Electricity."

Columbus, Ind.—Geo. Vorwald, City Clk., writes that no bids were received on Oct. 5 for the construction of a wooden filtration gallery in White River.

Spencer, Ind.—It is reported that an election will probably soon be held to vote on constructing municipal water works, to cost about $15,000.

Marlow, Ind. Ter.—Jas. R. Rogers, Town Recorder, writes that bonds to the amount of $20,000 have been sold for water works. Engineer, Griffin O'Neil, Dallas, Texas.

Madrid, Ia.—It is reported that bids will be received until Oct. 18 by C. S. Adams Town Clk., for 1½ miles pipe, 16 hydrants, 120 ft. tower, 50,000 gal. tank, and a gasoline engine. Burns & McDonnell, Dwight Bldg., Engrs., Kansas City, Mo.

**Des Moines, Ia.*—O. P. Herrick, of Des Moines, is reported to have secured the contract for laying a fire protection water main around the foundation of the state house, for $3,950.

Pineville, Ky.—The Pineville Water Supply Co. contemplates installing a new pump with a capacity of 500 to 1,000 gals. per minute.

Lowell, Mass.—R. J. Thomas, Supt. Water Wks., writes that the regular force of the Water Dept. will construct the 2,000 ft. of 6-in. pipe extension of the water system to Atherton, but the Water Dept. is in the market for 100 tons of 6-in. pipe. The Shane Machine Co., of Lowell, has also petitioned for 1,700 ft. of 6-in. pipe extension for fire service.

Pittsfield, Mass.—The Bd. of Aldermen is reported to have adopted an order appropriating $2,500 for work in connection with increasing the city's water supply.

Elsie, Mich.—The question of constructing water works is reported under consideration here.

Ontonagan, Mich.—G. L. Claussen, of Houghton, is reported to have prepared plans for a larger water supply; the citizens are stated to have voted $6,500 for this purpose.

St. Clair, Mich.—Engrs. Brush & Allen, of Detroit, are reported to have been selected by the Bd. of Pub. Wks. to prepare plans and specifications for improvements to the water works.

Wyandotte, Mich.—The Council is reported to have authorized City Attorney Thiede to draw up a resolution providing for a special election to provide money to pipe the entire city with water mains.

**Republic, Mich.*—The Michigan Pipe Co., of Bay City, is reported to have secured the contract for constructing the proposed water works; cost reported to be $25,000.

Wesson, Miss.—The citizens are reported to have voted Oct. 5 to issue bonds for the construction of water works.

Albert Lea, Minn.—See "Sewerage and Sewage Disposal."

St. Louis, Mo.—The City Council is stated to have on Oct. 6 passed bill appropriating $385,000 for the improvement of the Water Dept. Of this amount $100,000 will be used for the purchase of meters and $285,000 for an extension of the service and improving several lines already in service.

Stevensville, Mont.—Chas. H. Buck is reported to have petitioned for a franchise for the construction of water works.

Mitchell, Neb.—Bids will be received at the office of the U. S. Reclamation Service, Chamber of Commerce Bldg., Denver, Colo., until Nov. 8, for the construction of about 50 miles of main canal, involving about 3,000,000 cu. yds. earthwork and 130,000 cu. yds. rock work, for the irrigation of lands in North Platte Valley, Wyo. and Neb., as advertised in The Engineering Record.

Lincoln, Neb.—The City Council on Oct. 2 decided to lay 4 and 6-in. water pipe in numerous streets of the city.

Bassett, Neb.—Bids will be received by the Village Board (W. T. Phillips, Clk.) until Oct. 30 for furnishing material and constructing water works, as advertised in The Engineering Record.

North Platte, Neb.—Bids will be received at the office of the Engineer, U. S. Reclamation Service, Chamber of Commerce Bldg., Denver, Colo., until Nov. 8 for the construction of concrete culverts, siphons, drops, flumes, waterways, bridge abutments, etc., and furnishing 10 combination highway bridges and 570,000 lbs. steel, the work to be done along line of Interstate Canal from Whalen to Torrington, Wyo., in connection with the North Platte project, Neb., as advertised in The Engineering Record.

Goffstown, N. H.—A new concrete steel reservoir dam for additional water storage is being constructed for this village; plans furnished by the Amburen Hydraulic Constr. Co., 176 Federal St., Boston, Mass. A. W. Dudley, Manchester, N. H., Consulting and Supervising Engr.

Avon-by-the-Sea, N. J.—Bids will be received until Oct. 23 by the Mayor and Council for constructing about 18,000 ft. iron water pipe. R. C. Love, Boro. Engr.; John Thomson, Mayor.

Orange, N. J.—The date of opening of bids for constructing the new water distributing system has been extended from Oct. 9 to Oct. 23; probable cost of work, $200,000. It is proposed to construct a distributing reservoir and lay about 8,000 ft. 20-in. c. i. mains and 19,000 ft. of 24-in. c. i. mains and appurtenances. Alternative bids will be received for 19,000 ft. 30-in. c. i. mains, etc.

New York, N. Y.—Bids will be received until Oct. 25 by John T. Oakley, Comr. Water Supply, Gas and Electricity, for furnishing, constructing and installing 5 electrically-driven pumps, with all appliances, complete, for high-pressure fire service, in a pumping station to be erected on Gansevoort and West Sts.; also 5 pumps for station on Oliver and South Sts., both in Boro. Manhattan; bids will also be received Oct. 18 for hauling, laying and relaying water mains in a portion of 233d St., Boro. Bronx.

Items marked thus give the names of parties awarded contracts.

**Troy, N. Y.*—The contract for cleaning and grubbing Tomhannock reservoir is stated to have been awarded to Richard Ward, Jr., at $16,770. He also received the contract for cleaning the canal leading to the Tomhannock tunnel, at $2,280.

Rugby, N. D.—The Council is reported to be considering the question of constructing water works.

Toledo, O.—New bids will be received by the Bd. of Pub. Service (Harry Jones, Secy.) until Nov. 6 for the construction of Sections 1 and 2 of the filtered water conduit (contracts Nos. 2 and 3 of the improvement of the water supply) as the party to whom contract was recently awarded, failed to secure the requisite bonds. The specifications and plans remain the same. Chas. L. Parmelee, Consulting Engr., 136 Liberty St., New York, N. Y.; Edw. D. Bolton, Dept. Engr., Toledo; Frank I. Consaul, Ch. Engr., Toledo.

**Newark, O.*—The contract for the construction of municipal water works is reported to have been awarded to the American Light and Water Co., of Kansas City, Mo. (bids opened Sept. 30) for $266,843.

Portsmouth, O.—Filmore Musser, City Aud., writes that at the election Nov. 7 the citizens will vote on the question of issuing $250,000 bonds for water works improvements.

Alliance, O.—It is stated that bids will be received until Oct. 18 by the Bd. Pub. Service (C. E. Harsh, Clk.) for constructing a smoke stack, 100 ft. high, at the water works pumping station. Stack is to be of brick or iron, lined with brick.

St. Johns, Ore.—The Town Council is reported to be considering the question of constructing water works.

Cincinnati, O.—Bids will be received until Nov. 10 by the Bd. Trus., Comrs. Water Works (Aug. Hermann, Pres.) for laying about 6,100 lin. ft. 48-in. c. i. pipe and special castings in portions of Eastern, Columbia and Humboldt, Aves., for the extension and betterment of the water distribution system; also furnishing and delivering steel pipe for the filtration plant and settling reservoirs.

Acting Ch. Engr. Benzenberg has reported to the Bd. of Water Comrs. that it will cost $47,500 to furnish the sand and gravel needed for the filter plant.

Snyder, Okla. Ter.—The Navajoe Water User Assoc. is reported incorporated with a capital of $1,800,000 for the purpose of erecting an irrigation reservoir at Navajoe Mountain. Incorporators: H. L. McCowan, W. F. Fuqua, and T. M. Brown.

Roseburg, Ore.—See "Power Plants, Gas and Electricity."

**Philadelpia, Pa.*—We are informed that the D'Olier Eng. Co., 121 S. 11th St., Philadelphia, has secured the contract for pumping out Torresdale conduit, bids opened Oct. 3 by the Dept. of Pub. Wks., Bureau of Filtration (Geo. Webster, Acting Ch. Engr.). The following are the bids received for this work: (*a*) pumping out Torresdale conduit, circular 1 ft. 7 ins. diam., 13,969 ft. long, center line 100 ft. under surface of ground; (*b*) maintaining and operating pumps necessary to pump 1,200 gal. of water per minute and maintaining and operating a mine cage in Shaft No. 11, per day; (*c*) pumpage in excess of 1,200 gal. per minute per million gal.: Chas. Crowley, 67 Laurel St., *a* $19,900, *b* $86, *c* $110; D'Olier Eng. Co., *a* $12,700, *b* $120, *c* $25; Jos L. Sweigard & Co., 1119 Betz Bldg., *a* $31,400, *b* $150, *c* $75; Pneumatic Eng.. Co., 11 Bway, New York, N. Y., *a* $19,875, *b* $55, *c* $7; Jos E. McMenamy, Holmesburg, Philadelphia, *a* $18,694, *b* $230, *c* $200.

**Homestead, Pa.*—Andrew Hill, Clk. of Council, writes that the contract for 150-hp. tubular boiler for the water works (bids opened Oct. 2) has been awarded to Erie City Iron Wks., Park Bldg., Pittsburg, for $1,525.

Albion, Pa.—See "Power Plants, Gas and Electricity."

Wagner, S. D.—The citizens are reported to have voted to issue $10,000 bonds for the construction of water works.

Belle Fourche, S. D.—Plans and specifications are on file at the office of The Engineering Record, 114 Liberty St., New York, N. Y., for the construction of an earthen dam and appurtenances, and 17½ miles of canals, to be located about 12 miles n. e. from Belle Fourche; bids for which will be opened on Oct. 26 at the office of the U. S. Reclamation Service, Belle Fourche (Raymond F. Walter, Engr. in Charge) as advertised in The Engineering Record.

Orange, Tex.—See "Power Plants, Gas and Electricity."

Floresville, Tex.—It is reported that new bids are to be received until Oct. 16 for boiler, heater, pump, etc. H. C. Thompson, City Secy.; M. Griffin O'Neil, Engr., Dallas, Tex.

Brownsville, Tex.—T. W. Carter, 114 N. 4th St., St. Louis, Mo., Pres. of the American Rio Grande Land & Irrigation Co., writes that surveys are being made for the work contemplated by this company; the probable cost is from $100,000 to $250,000. Engineer, Chester B. Davis, Harlingen, Tex.

Ballinger, Tex.—The Mayor writes that it is proposed to expend about $12,500 on city water works this fall.

Houston, Tex.—The American Rio Grande & Irrigation Co. is reported incorporated, with a capital of $1,150,000, to irrigate land along the Rio Grande River.

**Ft. Worth, Tex.*—The Leversedge Bridge Co., of Ft. Worth, has secured the contract for constructing a 2,000,000 gal. reservoir (bids opened Sept. 9) for $12,900.

Salt Lake City, Utah.—The joint citizens and special water committee, are stated to have adopted a resolution recommending that the City Council appropriate $5,000 to conduct experiments as to the flow from the well near Liberty Park for the purpose of securing an additional supply. Geo. W. Riter, City Engr.

Norfolk, Va.—The Water Bd. is reported to have recommended to the Common Council the purchase of the Northwestern arm of Little Creek, which will about double the water supply of the city.

**Spokane, Wash.*—The Washington Brick, Lime & Mfg. Co. is reported to have secured the contract for 10,000 bbls. of cement to be used in the construction of the new reservoir at $3.25 per bbl.

Hillyard, Wash.—The Hillyard Water Co. is reported to be considering the question of enlarging and improving its plant.

Sunnyside, Wash.—O. L. Waller, of Pullman, has prepared plans for water works for Sunnyside, to cost about $16,000. Wm. H. Bridgman, Mayor.

Burlington, Wash.—A. L. Morris, of Burlington, writes that it is proposed to construct water works, to cost about $18,000. Bids will be received about Dec. 1.

Seattle, Wash.—Bids will be received until Oct. 21 by the Bd. Pub. Wks. (B. B. Bagley, Secy.) for laying a water main in a portion of Westlake Ave.; estimated cost, $7,250.

Appleton, Wis.—Geo. W. Sturtevant, of Chicago, Ill., is reported to have completed plans for the proposed municipal water works.

West Allis, Wis.—The Village Bd. of Trus. is stated to have decided to procure bids for the construction of a pumping station and equipment, including 2 electric cranes.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

San Francisco, Cal.—Bids are about to called for by the Bd. of Pub. Wks. for the construction of sewers in Baker St., bet. Lyon and Lewis Sts.; cost about $55,000.

Hartford, Conn.—City Engr. Ford has reported to the Bd. of Street Comrs. in favor of rebuilding the 24-in. brick sewer in Avon St. from Windsor to Portland St.

Jacksonville, Fla.—See "Water."

Chicago, Ill.—The following are the bids opened on Sept. 27 by the Dept. of Pub. Wks. for sewage screens and operating galleries for the 39th St. pumping station: Hansel Elcock Co., $2,600; Jackson & Corbett Co., $3,900, and F. P. Smith Wire & Iron Wks., $2,740.

Bids will be received by the Bd. Local Improv. (John A. May, Secy.) until Oct. 18 for constructing vitr. tile pipe sewers, with manholes and catch basins in portions of several streets.

Batavia, Ill.—Bids will probably be received in the spring for the construction of a system of pipe sewers; probable cost $75,000. Engineer, C. A. Prout, Wheaton.

Indianapolis, Ind.—Bids will be received until Oct. 20 by the Bd. Pub. Wks. (M. A. Downey, Pres.) for constructing a 10-in. pipe sewer in a portion of Maryland St.

Decatur, Ind.—The City Council is reported to have adopted a resolution providing for the construction of an 8-in. sewer on Neptune St., to connect with the Elm St. sewer.

Cresco, Ia.—Only one bid was received on Oct. 2 for constructing 2 sewers, which was rejected. W. L. Richards, Chmn. Sewer Com.

*M. T. Tschirge, of Dubuque, has secured the contract for a sewage disposal plant (bids opened Oct. 2) for $1,798.

**Cedar Falls, Ia.*—The contract for constructing sanitary sewers in Cedar Falls, has been awarded to W. A. Edgar, of Cedar Rapids, at 47 cts. per lin. ft. for 8-in. pipe; 60 cts. for 12-in. pipe; $30 each for manholes, and $60 for flush tanks.

Sheldon, Ia.—Bids will be received until Dec. 11 by the City Council at the office of G. T. Wellman, City Clk., for furnishing material and constructing sewers, to consist of about 3,870 ft. 8-in., 670 ft. 12-in. and 5,864 ft. 15-in. pipe; also sewage disposal works, to consist of septic tank and sand filter beds. Plans and specifications may be had upon a deposit of $10, $5 of which will be refunded upon return of the plans and specifications.

Clinton, Ia.—Chas. P. Chase, City Engr., writes that new bids will be called for on Oct. 25 for about 4 miles of reinforced concrete, brick and pipe sewers 2 to 10 ft. in diameter.

Winfield, Kan.—The City Clk. writes that this city will probably construct a sewerage system, to cost about $10,000, but nothing definite has yet been done.

Grosse Pointe, Mich.—It is reported that bids will be received until Nov. 4 by J. G. Armstrong, Village Clk., for laying about 1,800 ft. pipe sewer in Kirby Road. French & Russell, Engrs., Detroit.

Albert Lea, Minn.—Press reports state that bids are wanted until Oct. 24 for constructing several thousand ft. sewer; probable cost, $20,000; also 2 extensions of water mains.

Minneapolis, Minn.—Local press reports state that preliminary preparations for the building of about 10 miles of sewers next year are about to begin by Carl Illstrup, Engr. of sewers; about $200,000 is available for this work.

**St. Paul, Minn.*—The following are the bids opened on Oct. 5 by the Bd. of Pub. Wks. for constructing the Fairview Ave. sewerage system, consisting of 8,910 lin. ft. 9 to 24 in. pipe sewers, 508 lin. ft. 3 ft. 3 in. circular brick sewer, and 48 catch basins: Jas. Forrestal Co., 508 Scandinavian-America Bank Bldg.., $24,430 (awarded contract); Ryan & Johnson, 904 Lincoln Ave., $25,300; J. M. Thornton, 323 Gilfillan Blk., $24,716, and W. J. Prendergast, 556 Gilfillan Blk., $25,000. Jas. Forrestal Co. also secured the contract for constructing sewers on Minnehaha St., including pump house and machinery (bids opened Oct. 5) for $13,617.

North Platte, Neb.—It is reported that new bids will be received until Oct. 27 for constructing sewer mains. Chas. Samelson, City Clk.

South Omaha, Neb.—Herman Beal, City Engr., writes that an election will be held Nov. 7 to vote on the question of constructing a sewerage system, to cost about $250,000.

South Orange, N. J.—At a meeting of the South Orange Township Com. on Oct. 3, an ordinance was introduced providing for the construction of sewers in the Maplewood section of the township.

Irvington, N. J.—An ordinance is reported to have been introduced in Council, providing for the construction of 17 miles of lateral sewers. It is explained that it is not the desire to go ahead with such a vast project, but that the Board desired to have such an ordinance so as to enable it to facilitate sewer work on certain streets as the occasion demands.

**Haddonfield, N. J.*—Allen Clymer, Boro. Clk., writes that the contract for the construction of about 2 miles of pipe sewers (bids opened Oct. 4) has been awarded to S. L. Bartholomew, of Asbury Park, on the percentage basis. Mr. Bartholomew is to superintend the work, furnish all machinery and tools and is to receive 12 per cent. of the cost, as estimated by the engineer or less. The estimated cost is $17,222. The contractor is to receive no percentage on the excess, if it exceeds the engineer's estimate.

Engineer W. W. Young, of White Plains, N. Y., writes that bids are wanted by J. Morris Roberts, Mayor, Haddonfield, for material required for the construction of sewers, as follows: 8,375 ft. 8-in. pipe, 500 ft. 10-in., 100 ft. 12-in., 300 8-in. terra cotta flush Y branches and 30 10-in. branches; 500 ft. 4-in. drain tile underdrain; 1,900 ft. 8-in. c.-i. pipe with 4 ft. of cover; 1 c.-i. gate valve; 1 receiving well and superimposed pump house; 1 electric motor, 5 brake hp.; 1 5-hp. centrifugal pump; 7 flush tanks; 17 manholes, with covers, etc. Complete list of material required on file at the office of The Engineering Record, 114 Liberty St., New York, N. Y.

Perth Amboy, N. J.—Bids will be received until Oct. 16 by the City Council for constructing approximately 1,700 lin. ft. 24-in. salt-glazed vitr. clay pipe sewer, 8 manholes, etc., in a portion of Sayre St. Wm. H. Fullerton, St. Comr.

Jersey City, N. J.—Bids will be received until Oct. 17 by the Bd. Street and Water Comrs. (Geo. T. Bouton, Clk.) for constructing about 500 lin. ft. 36-in. circular brick supplemental sewer.

Avon-by-the-Sea, N. J.—Bids will be received until Oct. 23 by the Mayor and Council for constructing about 12,000 ft. sewer pipe. R. C. Love, Boro. Engr.; John Thomsoan, Mayor.

**Newton, N. J.*—Contracts for sewer work (bids opened Sept. 2) have been awarded as follows: To Allen & Wolfe, of Standhope, for constructing 7 miles of pipe sewers for $43,291; to Hinman & Sproul, Schenectady, for 2 sewage disposal plants, $29,618, and to the St. Mary's Sewer Pipe Co., St. Marys, O., for sewer pipe at $9,569. Engineers, Williams & Whitman, Inc., of New York, N. Y. For list of detail bids received for this work see issue of The Engineering Record, Sept. 16.

Plainfield, N. J.—Bids are wanted Nov. 6 for furnishing material and constructing 568 ft. concrete sewer, 2 manholes, 8 branches, 12 inlets and basin connections. J. T. MacMurray, City Clk.; Andrew J. Gavett, City Surveyor.

Woodstown, N. J.—The Woodstown Sewer Co. is reported incorporated by Allen J. Davis, Geo. H. Crothers, and others, all of Woodstown, to operate a sewerage system in Woodstown.

**Albany, N. Y.*—Cameron & Hawn are reported to have secured the contract for constructing sewers in Steuben and Elk Sts. and in Upper Western Ave., for $12,412.

**Rochester, N. Y.*—H. N. Cowles is stated to have on Oct. 5 secured the contract for constructing a sewer in Melville St., for $11,912.

Troy, N. Y.—Bids will be received until Oct. 17 by the Bd. Contract and Supply (Jas. M. Riley, Clk.) for furnishing material and constructing a salt- glazed vitr. drain pipe sewer in a portion of Maple Ave., requiring 950 ft. 24-in. pipe, 36 laterals each 14 ft. long, of 8-in. pipe, 4 manholes and 2 catch basins.

Syracuse, N. Y.—The Onondago Creek Comn., with O. V. Tracy, Chmn., and Edwin M. Wells, Secy., submitted to Council on Oct. 2 its final report on improving Onondago Creek. It recommends the enlargement and improvement of the Creek Channel at a cost of $677,000, and the construction of an intercepting sewer at a cost of $215.000.

Brooklyn, N. Y.—Bids will be received until Oct. 18 by Martin W. Littleton, Boro. Pres., for constructing and reconstructing sewers in portions of several streets. Engineer's estimate: 3,006 ft. 12-in., 150 ft. 15-in., and 697 ft. 18-in. pipe sewer; 298 cu. yds. concrete cradle; 39 manholes; 20,100 ft. B. M. foundation planking; 70,000 ft. B. M. sheeting and bracing, etc.

Mohawk, N. Y.—The citizens are reported to have voted to construct a sewerage system.

**Spencer, N. C.*—C. Markley, of Roanoke, Va., is stated to have secured the contract for sewers, street improvements and sidewalks, for about $35,000.

Napoleon, O.—It is stated that bids will be received until Nov. 6 for constructing sewers. Fred W. Hilgendorn, Village Clk.

Canton, O.—It is stated that bids will be received until Oct. 18 by the Bd. Pub. Service (C. A. Zellers, Clk.) for constructing a short storm water sewer; also for sanitary sewer in Fulton St. and a storm water sewer in Hurford St.

Glendale, O.—Bids will be received until Nov. 6 by J. G. Gestling, Clk., for furnishing material and constructing sewers in portions of Oak and Sharon Aves.

Akron, O.—The Council has passed an ordinance declaring it necessary to construct a sanitary sewer from Kenmore Boule. to the junction of Wolf and Bowery Sts.; probable cost $40,000.

City Engr. F. M. Turner is stated to have completed his report on the sewage pumping station on Longworth St. He recommends a new pump house at a cost of $4,000 and the installation of three 15-in. centrifugal pumps, to be operated by electric motors at a cost of $6,620; total cost $10,620.

***Items marked thus give the names of parties awarded contracts.**

**Salt Lake City, Utah.*—The following are the bids opened on Oct. 4 by the Bd. of Pub. Wks. for constructing an intercepting sewer and pumping station: (*a*) Jas. Kennedy, Fargo, N. D. (awarded contract), (*b*) R. C. Storrie, Dallas, Tex., (*c*) Lynn S. Atkinson, (*d*) P. J. Moran, Salt Lake City. Geo. W. Riter, City Engr. In regard to the kind of material, Geo. M. Bacon, Engr. in charge, states that about 60 per cent. of the work lies in ground consisting largely of sand, this sand, however, not being fine enough to be considered quicksand. The rest of the ground consists of alternate layers of rather stiff clay and clay sand and practically in all the ground there is a great deal of water present which will increase very materially in amount during the spring months.

	**a*	*b*	*c*	*d*
48,000 cu. yds. earth excav. for sewer	$1.70	$2.45	$1.70	$1.85
1,100 cu. yds. earth excav. for pumping station	1.70	2.50	1.50	1.85
5,500 lin. ft. 30x45-in. concrete sewer	2.80	4.00	5.00	3.20
4,700 lin. ft. 27x42-in. concrete sewer	2.75	3.75	4.50	3.00
3,100 lin. ft. 28-in. brick sewer	3.50	2.00	2.00	3.40
4,700 lin. ft. 15-in. vitr. pipe sewer	1.10	1.50	1.00	1.20
3,900 lin. ft. 12-in. vitr. pipe sewer	.80	1.00	.80	.90
6,500 lin. ft. 6-in. pipe subdrain	.20	.60	.60	.23
15 M. ft. wood subdrain	40.00	75.00	60.00	40.00
350 cu. yds. Portland cement concrete in pumping sta.	11.00	12.00	10.00	12.00
400 cu. yds. brick masonry	20.00	14.00	15.00	18.00
20,000 lbs. setting iron and steel	.02	.02	.01½	.03
115,000 lbs. setting steel reinforcements	.02	.01	.03	.07
100 cu. yds. gravel fill	1.25	2.50	2.00	1.00
1,000 lin. ft. piling in sewer trench	.80	2.00	1.00	.75
Total	$148,350	$195,825	$165,220	$165,260

**Lawton, Okla. Ter.*—J. O. Severns, of Guthrie, is reported to have on Oct. 2 secured the contract for constructing an addition to the storm water sewer, for $38,000.

Grant's Pass, Ore.—Bids will be received until Oct. 20 by Frank Fitsch, Chmn. Sewer Com., care John Minor Booth, Auditor and Police Judge, for constructing 2 main sewers, one being 5,825 ft. and the other 8,640 ft. long.

Portland, Ore.—The lowest bid recently received for the construction of the Irvington Dist. sewer is stated to have been submitted by the Pacific Bridge Co., of Portland, for $133,765.

East Pittsburg, Pa.—Bids will be received until Oct. 18 by D. S. Shields, Chmn. Street Com., Box 66, for grading, paving, curbing and sewering in portions of Braddock and Electric Aves.; also constructing sewers in portions of several streets and a closed culvert on Electric Ave. Harrop, Hopkins & Taylor, Boro. Engrs., 1200 Lewis Blk., Pittsburg.

Groton, S. D.—Bids will be received until Oct. 23 by W. A. Burnham, City Aud., for constructing an extension to the sewerage system.

Covington, Tenn.—John Craig, Supt. Light and Water Wks., writes that it is proposed to construct a sewerage system, cost not yet estimated. S. Smith, Mayor.

Chattanooga, Tenn.—Bids will be received by A. L. Thomas, Chmn. Bd. Pub. Wks., until Nov. 7 for the construction of 4,575 ft. brick sewer, 18,027 ft. vitrified pipe sewers, 68 manholes, including several special and drop manholes in which c.-i. pipe is used, etc., as advertised in The Engineering Record.

**Salt Lake City, Utah.*—The following are the bids opened on Oct. 4 for constructing the extension of the gravity outlet sewer: (*a*) Lynn S. Atkinson, Colorado Springs, Col., $26,300 (contingent on being awarded contract for intercepting sewer) (*b*) Jas. Kennedy, Fargo, N. D., $29,140 (awarded contract) (*c*) P. J. Moran, Salt Lake City, $34,240. Geo. W. Riter, City Engr.; Geo. M. Bacon, Engr. in charge:

	a	**b*	*c*
7,000 cu. yds. earth excav. for sewer	$.60	$1.20	$1.40
5,000 lin. ft. 32x42-in. con. sewer	4.00	3.80	4.00
30 cu. yds. brick masonry	15.00	18.00	18.00
10,000 lbs. setting iron and steel	.01½	.02	.04
50,000 lbs. setting steel reinforcement	.03	.02	.07

Sparta, Wis.—A preliminary survey is reported to have been made for the construction of a sewerage system.

Guantanamo, Cuba.—Bids will be received until Nov. 7 at the Bureau Supplies and Accounts, Navy Dept., Washington, D. C., to furnish at the naval station, Guantanamo Bay, a quantity of vitr. sewer pipe, rubberoid roofing, metal lathing, etc. H. T. B. Harris, Paymaster Gen., U. S. N.

BRIDGES.

Notes Arranged Alphabetically by States.

Huntsville, Ala.—It is stated that bids will be received until Nov. 6 by the Co. Comrs. for constructing a steel bridge about 1 mile west of New Market on the New Hope Road.

San Bernardino, Cal.—It is stated that bids will be received until Nov. 6 by the Co. Comrs. for constructing a 1-span steel bridge at Idlewild, estimated to cost $2,400. M. L. Cook, Co. Surv.

San Francisco, Cal.—Plans have been submitted to the Bd. of Wks. for the completion and extension of a steel bridge at San Jose and Mt. Vernon Aves.; estimated cost $12,500.

**Washington, D. C.*—The contract for constructing a cocrete-steel arch bridge, in approach to highway bridge across Potomac River (bids opened Sept. 25 by Lieut. Col. R. L. Hoxie, Corps Engrs., U. S. A.) has been awarded to the Penn Bridge Co., Beaver Falls, Pa., for about $100,000. For detail bids received for this work, see issue of The Engineering Record Oct. 7.

Cedartown, Ga.—T. H. Adams, of the Polk County Comrs., writes that the question of constructing a steel bridge over Cedar Creek is under consideration. If constructed it will be about 80 to 90 ft. in length and have a span of 60 to 70 ft.

Chicago, Ill.—Bids will be received until Oct. 18 by the South Park Comrs. (E. G. Shumway, Secy.) for constructing a bridge in Jackson Park, near the lake shore, nearly opposite 59th St.

South Bend, Ind.—Bids will be received by the County Comrs. until Nov. 8 for building concrete substructure and removing Jefferson St. Bridge to Springbrook Park, over St. Joseph River; 3 spans, 480 ft.; cost about $26,000. John W. Harbon, Co. Aud. Engineer, Alonzo J. Hammand, of South Bend.

Wichita, Kan.—C. N. Cartwright, County Clk., writes that bids will be received until Oct. 23 for the construction of one 60-ft. steel bridge and 2 pile bridges.

Newport, Ky.—See "Railroads."

Two Harbors, Minn.—It is stated that bids will be received until Oct. 17 by the Co. Comrs. for constructing a steel bridge across Knife River. John P. Paulson, Co. Aud.

Wabasha, Minn.—Bids will be received until Oct. 17 by the Bd. Co. Comrs. for erecting a steel 60-ft, span, 1,600-lb. bridge, to be constructed in Sec. 6, Town of Highland. Fred F. Bade, Co. Aud.

Kansas City, Mo.—The Chicago, Rock Island & Pacific R. R. Co. (W. L. Darling, Ch. Engr., Chicago) is reported to have been making surveys for the construction of a 2-span, 310-ft. steel bridge over the Kaw River, at Kansas Ave.; probable cost, $120,000.

North Platte, Neb.—See "Water."

Trenton, N. J.—Bids will be received until Oct. 19 by the Finance Com. Co. Bd. Chosen Freeholders, for $54,900 bridge bonds.

Akron, O.—It is stated that bids will be received until Oct. 28 by the Co. Comrs. for constructing an iron bridge, 60 ft. extreme length, with 16 ft. concrete top roadway and 4 ft. concrete sidewalk. M. D. Buckman, Co. Aud.; J. A. Gehres, Co. Surv.

**Troy, O.*—E. E. Pearson, Co. Aud., writes that the contract for constructing the superstructure of a high truss bridge across Stillwater River (bids opened Sept. 30) has been awarded to the Central States Bridge Co., of Indianapolis, Ind., for $4,280.

• *Philadelphia, Pa.*—Plans and specifications are stated to have been completed under the direction of Geo. S. Webster, Chief of the Bureau of Surveys, and contracts will probably soon be let for the following bridges: At Front St., over tracks of New York Div. of the Pennsylvania R. R.; another at 25th St., over the Pennsylvania R. R. tracks; also one at Wyoming Ave., over the tracks of the Philadelphia & Newton R. R., and another over the Wissahickon. at Allen's Lane.

Memphis, Tenn.—Bids will be received until Nov. 6 by the Shelby County Levee Comn. (Chas. A. Barton, Engr., Rm. 10, Odd Fellows Bldg.) for constructing two 50-ft. span steel highway bridges on concrete piers, a 20-ft. span steel highway bridge, 1,065 ft. steel highway trestle and the raising of 227 ft. steel truss highway bridge, as advertised in The Engineering Record.

Norfolk, Va.—S. Heth Taylor, Lowenberg Bldg., Norfolk, writes that the Norfolk Viaduct Corporation, of which he is president, proposes constructing an aerial ferry bridge or viaduct, for which plans have been approved by the Government, and which is expected to be ratified by the local Bd. of Harbor Comrs., giving a clear water space between piers of 600 ft., and a clear height from the lowest chord above mean low water of 175 ft. It is also probable that viaduct approaches about 500 ft. long will be necessary at both ends of the ferry bridge. The plans as approved by the Government provide for a stiff structure, but it is the purpose of the company to ask bidders to submit their own designs showing either a suspension type or the stiff structure. Engineer in charge, T. F. McGilvray, City Engr., of Duluth, Minn. It has not yet been determined when bids will be asked, as certain details, rights of way, etc., have to be perfected before specifications can be prepared.

Aberdeen, Wash.—It is stated that bids will be received until Oct. 30 for constructing steel superstructure of bridge across Wishkah River, estimated to cost $30,000. P. F. Clark, City Clk.

Charleston, W. Va.—Bids will be received until Oct. 19 by the Finance Com. of City Council (Wm. B. Mathews, Chmn.) for $60,000 bonds for erecting a bridge, or bridges, across Elk River.

Racine, Wis.—The Council is stated to have decided to adopt the plans of John Geist, of Milwaukee, for the Main St. Bridge. It will be a swing structure, and cost $72,000.

**Hurdmans Bridge, Ont.*—C. Macrab, County Clk., Ottawa, writes that the Steel & Concrete Bridge Co., of Montreal, Que., has secured the contract for constructing a bridge here, for about $20,000.

PAVING AND ROADMAKING.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—The City Council is stated to have passed an ordinance providing for the paving of a portion of 24th St., at a cost of $14,000.

San Francisco, Cal.—The Bd. of Pub. Wks. is reported to have requested the Supervisors to authorize an expenditure of $11,000 in repaving Stockton St., from Union to Greenwich Sts., with bituminous rock asphalt.

The Bd. of Wks. has decided to repave Larkin St., from Hayes to McAllister Sts., with asphalt on concrete; cost about $9,500; also Pacific St., from Kearney to Stockton St., with basalt on concrete; cost $11,000.

The City Engr. is reported to have been directed by the Bd. Pub. Wks. to prepare specifications for paving with asphalt on Misson St.

Hartford, Conn.—The Bd. of Street Comrs. is stated to have decided to construct a big highway 60 ft. wide across Pope Park, from Laurel St. to connect with Hillside Ave.

Jacksonville, Fla.—See "Water.."

Savannah, Ga.—It is stated that bids will be received until Oct. 23 by the Bd. Co. Comrs. (G. Reuben Butler, Clk.) for constructing a reinforced concrete roadway over Casey Canal outlet lock.

Columbus, Ga.—The following are reported to be the bids opened Oct. 3 for paving about 15,000 sq. yds. on Broad St.: (*a*) asphalt; (*b*) brick; (*c*) bitulithic; (*d*) bituminous macadam (price given per sq. yd.): Southern Paving & Constr. Co., *a* $1.81, *b* $1.69; Asphalt Paving Co., of Georgia, *a* $2.11; Southern Constr. Co., *a* $1.74, *b* $1.73, *d* $2.02; Southern Bitulithic Co., *c* 3 bids, $1.77, $1.87 and $2.02.

*The Southern Bitulithic Co .is reported to have secured the contract on the above paving at $1.87 per sq. yd.

East St. Louis, Ill.—The City Council has passed ordinances authorizing the improvement of 9th St., from St. Louis Ave. to Missouri Ave.; and St. Clair Ave., from 1st St. to the Terminal Ry. Right of Way. Vitr. brick on 6-in. concrete will be used on both streets. W. J. Crocken, City Engr.

**Springfield, Ill.*—John E. Bretz is stated to have secured the contract for paving with brick a portion of English Ave., at $1.57 per sq. yd.

**Ft. Sheridan, Ill.*—Capt. Wm. Weigel, Q. M., U. S. A., writes that the contract for constructing walks, roads, etc., around buildings at this post (bids opened Sept. 20) has been awarded to Jas. Cape & Sons, of Racine, Wis., for $13,540.

Freeport, Ill.—Bids will be received until Oct. 19 for macadamizing Cottonwood St., estimated to cost $8,000, as advertised in The Engineering Record.

Harvey, Ill.—G. G. Van Alstine is reported to have received the contract for paving with brick on Center St., at $1.88 per sq. yd.

Evansville, Ind.—The Bd. of Pub. Wks. is stated to have passed a resolution providing for the paving of a portion of 6th St.

**South McAlester, Ind. Ter.*—The following are the bids opened on Oct. 2 by the Improvement Bd., for paving Choctaw Ave. with brick, 15,000 sq .yds. (price given per sq. yd.): Hanley & Ritchie, Topeka, Kan., $2.24½; T. Dunlap, Edwardsville, Ill., $2.08 (with limestone base) (awarded contract); he also bid $2.14 with flint base; Cook & Son, Muskogee, $2.23½; Chas.. T. Deer, Guthrie, $2.23; F. P. Williamson, South McAlester, $2.26 (firestone base), $2.27 (flint base); Anton Schrimer, South McAlester, $2.10 (flint or limestone base).

Indianapolis, Ind.—Bids will be received until Oct. 20 by the Bd. Pub. Wks. (M. A. Downing, Pres.) for grading and paving a portion of Indiana Ave., with brick.

Crownpoint, Ind.—W. L. Allman, Co. Aud., writes that all bids opened on Oct. 7 for constructing 11 miles of gravel roads in Hobart Township and 2 miles on the county line, have been rejected, and new bids will be received on Nov. 6. Saml. Love, Chmn. Co. Comrs.

Des Moines, Ia.—The City Council is stated to have authorized the Bd. of Pub. Wks. to receive bids for curbing and paving with brick portion of Woodland Ave., curbing portion Kingman Boule. and Maiden Lane; also for paving with brick north and south alley from Walnut to Locust St.

Atchison, Kan.—Resolutions have been passed by the Mayor and Council, providing for the paving of R and Q. Sts. and the alley in block 4, with brick, to consist of 2,305 sq. yds. paving and 1,280 lin. ft. curb.

**Boston, Mass.*—The contract for repaving a portion of State St. (bids opened by the Boston Transit Comn., Oct. 5) has been awarded to Daniel J. Kiley, 95 Milk St., for $2,175.

**St. Paul, Minn.*—The Bd. of Pub. Wks. is stated to have awarded the contract for constructing a gravel roadway in a portion of Minnehaha St. to W. J. Prendergast, at $18,000.

Hazlehurst, Miss.—It is stated that Copiah County will issue $50,000 road and refunding bonds. Address, Chancery Clerk.

Concord, N. H.—Bids will be received until Oct. 21 by A. W. Dean, State Engr., for constructing roads in several towns.

Hoboken, N. J.—It is stated that bids will be received until Oct. 25 by the Mayor and Council for improving Adams St., between 6th and 8th Sts., by grading, curbing and paving with Belgian block. Jas. H. Londrigan, City Clk.

Atlantic City, N. J.—The City Council is stated to have passed a bill providing for the paving of Atlantic Ave. with Trinidad asphalt.

Trenton, N. J.—Bids will be received until Oct. 17 by the Common Council for paving a portion of Brunswick Ave. with sheet asphaltum over asphalt block. Harry B. Salter, City Clk.

Newark, N. J.—The Bd. of Pub. Wks. is stated to have passed on second reading the ordinance providing for the paving with either brick or granite block on a portion of Johnson St.

*The contract for grading, curbing and flagging a portion of Elizabeth Ave. is stated to have been awarded to Philip Jamerone, for $10,367.

Harrison, N. J.—The Town Council is stated to have decided to reject all bids received for paving a portion of Hamilton St. with telford. According to reports new bids will be received.

Jersey City, N. J.—Bids will be received until Oct. 19 by the Co. Bd. Chosen Freeholders (John P. Egan, Clk.) for reconstructing and improving a portion of the Newark and New York Turnpike.

New York, N. Y.—The Bd. of Aldermen is stated to have passed an ordinance providing for the issue of corporate stock amounting to $25,000 for the improvement of roadway of Delancey St., from the Bowery to Norfolk St.

New York, N. Y.—Bids will be received until Oct. 19 by the Park Bd. (John J. Pallas, Pres.) for paving with asphalt the existing walks in St. Mary's Park, Boro. Bronx..

**Items marked thus give the names of parties awarded contracts.*

**Brooklyn, N. Y.*—The following are the bids opened on Oct. 11 by Martin W. Littleton, Pres. Brooklyn Boro., for regulating and repaving with granite on concrete foundation, Stagg St., from Bushwick to Morgan Ave. (bidders of Brooklyn, unless otherwise mentioned): (*a*) Geo. R. Davidson, 194 Stockton St., $17,949; (*b*) George & Farrell, 576 Douglass St., $17,828 (awarded contract); (*c*) Frank J. Gallagher, 574 Park Pl., $18,368; (*d*) U. L. Starr, 339 W. 43d St., N. Y. City, $20,192; (*e*) Norton & Gorman Con. Co., 303 Douglass St., $18,529; (*f*) O'Grady Bros., 72 N. 8th St., $18,328; (*g*) Cunningham & Kearns, 434 E. 91st St., N. Y. City, $18,546, and (*h*) Jas. Quinn, Jr., 1483 Ave. A, N. Y. City, $19,305.

	a	**b*	*c*	*d*	*e*	*f*	*g*	*h*
5,000 sq. yds. granite blk. pavt., with tar and gravel joints	$3.00	$2.35	$2.36	$2.63	$2.35	$2.43	$2.44	$2.43
50 sq. yds. of adjacent pavt.	.01	.25	.50	.15	.20	.01	.25	.50
970 cu. yds. concrete	3.00	4.00	4.00	4.65	4.50	4.00	4.00	4.45
2,260 lin. ft. new curb	.01	.77	.90	.90	.85	.85	.85	.85
600 lin. ft. old curb reset	.01	.34	.50	.24	.30	.01	.35	.95
290 sq. yds. new granite bridgestone	.01	.60	.95	.64	.70	.70	.65	.65
670 sq. ft. old bridgestone relaid	.01	.10	.08	.24	.15	.25	.20	.20

**Carrick, Pa.*—Wm. McClurg Donley, Boro. Engr., 1109 House Bldg., Pittsburg, writes that Ott Bros., Washington Ave., Pittsburg, on Oct. 2 secured the contract for grading, curbing and paving Brownsville Road for $83,416. He bid on Mack block. The following are the detail bids for this work, opened at Carrick on Aug. 28 by the Street Committee: (*a*) Ott Bros., Pittsburg; (*b*) M. O'Herron & Co., Pittsburg (using Mack block); (*c*) Jas. H. McQuade Co., Pittsburg (standard block); (*d*) Wm. J. Payne, Pittsburg (standard block); (*e*) Bowman Bros., McKeesport, Pa. (standard block); (*f*) T. B. Townsend Brick & Contracting Co., Zanesville, O. (Townsend block); (*g*) Sawders Paving & Constr. Co., Pittsburg (Pittsburg-Buffalo block). Paving is per yd and includes 6-in. concrete base, 2-in. sand cushion. Paving block to be filled with dry hot sand and coal tar paving cement. An up-hill haul of over 3 miles to get material on work is the cause of high prices.

	a	*b*	*c*	*d*	*e*	*f*	*g*
21,500 cu. yds. excav	$0.37	$0.40	$0.49	$0.39	$0.40	$0.40	$0.57
27,360 sq. yds. vitrified brick pavt	1.99	2.07	1.93	2.13	2.10	2.21	1.98
18,850 lin. ft. sandstone curb	.74	.70	.76	.70	.75	.65	.74
4,860 sq, ft. granite crossing	.70	.65	.70	.59	.90	.60	.65
890 lin. ft. 15-in. double strength pipe drain	.80	1.25	1.00	1.35	.75	1.50	.87
630 lin. ft. 12-in. pipe drain	.60	1.00	.85	1.15	.65	1.25	.76
22 catch basins	21.00	20.00	25.00	22.00	25.00	25.00	15.25
5 manholes	27.00	30.00	25.00	30.00	45.00	35.00	38.00
40 cement monuments (complete)	2.00	3.00	3.00	8.00	10.00	6.00	4.50
265 cu. yds. rubble masonry	6.00	5.50	3.50	5.25	4.50	6.00	4.00
740 lin. ft. supporting stone (sandstone)	.40	.45	.60	.40	.70	.40	.45
concrete in place per cu. yd	8.00	7.00	6.00	7.00	8.00	6.00	5.00
Relaying flagstone walks on new foundation, per sq. ft.	.15	.07	.15	.15	.10	.15	.08
Recut and reset old curb on new foundation, per lin. ft.	.40	.40	.50	.40	.40	.30	.30

**Seattle, Wash.*—The following are the bids opened on Sept. 30 for grading Louisa St.: (*a*) S. Normile, 608 Kinnear Place (awarded contract); (*b*) Andrew Peterson; (*c*) A. C Goerig; (*d*) Frank & Brandon:

	a	*b*	*c*	*d*
22.5 acres clearing and grubbing	$100.00	$100.00	$100.00	$95.00
110,000 cu. yds earthwork	.20	.24½	.28	.22½
20 cu. yds. solid rock	1.00	1.00	2.00	.23
267 M. H. B. M. curbs and gutters	15.00	16.00	18.00	14.00
25 M. H. B. M. bulkhead, lumber	18.00	20.00	18.00	20.00
3,000 lbs. iron	.08	.07	.05	.06
600 lin. ft. railing	.10	.10	.10	.10
Fixed estimate	1200.00	1200.00	1200.00	1200.00
Totals	$30,225	$35,462	$39,756	$32,570

Brooklyn, N. Y.—Bids will be received until Oct. 25 by Martin W. Littleton, Boro. Pres., for regulating, grading, paving and repaving portions of 5 streets. Engineer's estimate: 9,900 sq. yds. asphalt pavt.; 1,000 sq. yds. granite blk. pavt., with tar and gravel joints; 5,020 lin. ft. new curb; 1,910 cu. yds. concrete, etc.

**Watertown, N. Y.*—The contract for macadamizing Pearl St. is reported to have been awarded to Danl. Coleman at $8,040.

Buffalo, N. Y.—Bids will be received until Oct. 19 by the Dept. Pub. Wks. (Francis G. Ward, Comr.) for paving and repaving a portion of Court St.; also separate bids for paving and repaving a portion of Tonawanda St.

**Johnstown, N. Y.*—Contracts for paving with asphalt block (bids opened Oct. 2) has been awarded to the Hastings Pavt. Co., of N. Y. City, at $27,361 for Market St., and $5,117 for Perry St. For list of bids received for this work, see issue of The Engineering Record Oct. 7.

Spencer, N. C.—See "Sewerage and Sewage Disposal."

Cincinnati, O.—Bids will be received until Nov. 1 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for furnishing material, grading, curbing and paving with asphalt a portion of Wade St.

Bids will be received by the Bd. Co. Comrs. until Nov. 10 for constructing drains and remetaling a portion of Deerfield Road. Eugene L. Lewis, Co. Aud.

Cleveland, O.—The Bd. Pub. Service is stated to have awarded contracts for paving with medina block portions of Detroit St. and Willson Ave. to the Northern Ohio Paving & Constr. Co., for about $22,959 for the former, and the latter to the Standard Paving Co., of Columbus, for $11,824 (bids opened Sept. 18).

Trenton, O.—It is stated that bids will be received by Louis Brill, Jr., Village Clk., for constructing cement curbs, gutters and sidewalks on Miami St.

**Dayton, O.*—The contract for paving with Hocking Valley block a portion of O'Bell Court is reported to have been awarded to Geo. Hecker and John Kirshner, at $1.08 per sq. yd.

Bowling Green, O.—Bids will be received until Oct. 23 by the Bd. Co. Comrs. for grading, draining and macadamizing the P. C. Hoiles and S. B. Hengsteler roads. E. L. Spafford, Co. Surv.; B. C. Harding, Co. Aud.

Altoona, Pa.—Bids will be received until Oct. 25 by the Bd. Pub. Wks. (Andrew Kipple, Chmn.) for paving with brick on a 6-in. Portland cement concrete foundation, on Lexington Ave., 11th St. and 11th Alley, in all about 10,057 sq. yds., as advertised in The Engineering Record.

*The contract for paving 2d Ave., bet. 3d and 4th Sts., with brick, was awarded on Oct. 11 by the Bd. of Pub. Wks., to R. B. Vaughan, at $1.97 per sq. yd. Harvey Linton, City Engr.

East Pittsburg, Pa.—See "Sewerage and Sewage Disposal."

Oakmont, Pa.—Bids will be received until Oct. 16 by the Finance Com. (G. A. Schnabel, Chmn.) for $45,000 street improvement bonds.

**Everett, Wash.*—The City Council is reported to have awarded the contract for paving Broadway with creosoted blocks to Geo. McKenzie, for $51,500.

Racine, Wis.—The City Council is stated to have approved plans for the paving of Wisconsin St., at a cost of about $44,000.

Toronto, Ont.—Bids will be received until Oct. 17 by Thos. Urquhart (Mayor), Chmn. Bd. Control, for paving portions of several streets with asphalt and macadam; also constructing sidewalks on portions of numerous streets.

Spokane, Wash.—Bids will be received until Oct. 28 by the Bd. Pub. Wks. (J. T. Omo, Secy.) for paving a portion of Bernard St. and Second Ave.

The only bid opened Sept. 28 for paving a portion of Mill St. is reported to have been submitted by the Barber Asphalt Paving Co. for $8,300.

The following bids are reported to have been received for grading, curbing, parking and constructing sidewalks on a portion of 7th Ave.: Mitchell Bros., $10,500; Jas. B. Broad, $13,396, and. P. Costello, $12,000.

Bids for curbing and constructing sidewalks on a portion of Bridgeport Ave. are stated to have been as follows: Peter Costello, $8,900, and the Barber Asphalt Paving Co., $8,040.

POWER PLANTS. GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Benson, Ariz.—Doane Merrill writes that the Benson Light & Water Co. has not yet been organized; probable cost of proposed plant $5,000.

Washington, D. C.—Bids will be received until Oct. 24 at the Bureau Supplies and Accounts, Navy Dept., Washington, to furnish at the Navy Yards, etc., Portsmouth, N. H.; Boston, Mass.; New York, N. Y.; League Island, Pa.; Annapolis, Md.; Washington, D. C., and Norfolk, Va., a quantity of naval supplies, as follows: Electrical cable; incandescent lamps; electrical supplies; thermostats; sockets; wire, conduit and fittings; Portland cement; pipe-bending machine; steel channels; expanded metal; windlasses; hydraulic jacks; gate valves; pipe fittings; bar and sheet steel; sheet copper, etc. H. T. B. Harris, Paymaster Gen., U. S. N.

We are informed under date of Oct. 9, that the contract has not yet been let for the heating, lighting and power plant for the Capitol and other buildings, bids for which were opened on Sept. 30, the result of which was reported in the issue of The Engineering Record Oct. 7. The matter is at present in the hands of an advisory committee, who will report to Elliott Woods, Supt. U. S. Capitol Bldg. and Grounds, after which he will report to the House Building Commission.

Mayo, Fla.—The Town Council is reported to have granted Clarence H. Ellis and associates, a franchise for the construction of water works and an electric light plant.

Columbus, Ga.—The City Council, it is stated, is considering the cost of a municipal electric light plant.

Rockmart, Ga.—B. Stark, City Clk., writes that it is proposed to construct an electric light plant to cost about $7,000.

Lagrange, Ga.—Mayor Edmondson writes that the city has under consideration the question of granting a franchise for a gas plant.

Ocilla, Ga.—The Mayor and Bd. of Aldermen is stated to have awarded to Engineer J. B. McCrary, of Senora, the contract for water works and an electric light system, to cost about $28,000.

Indianapolis, Ind.—The Indianapolis Union Ry. Co. is reported to have approved plans for a heating and lighting plant for the union station, to cost about $75,000.

*The Co. Comrs., it is reported, have awarded to the Westinghouse Machine Co., of Pittsburg, Pa., the contract for the smoke consuming and fuel-saving device for the county power house, at about $5,400.

West Terre Haute, Ind.—The Town Trus. are reported to have granted the West Terre Haute Light & Power Co. a franchise to construct and operate an electric light plant. Claude Erwin is one of the incorporators.

Scottsburg, Ind.—Messrs. Smith and Shea, it is reported, have been granted a franchise to construct a combined electric light plant and water works, and it is stated that bids will be asked for the construction as soon as plans have been prepared.

Charles City, Ia.—A. L. Dodd, of Charles City, and F. O. Martin, of Floyd, it is stated, have purchased the electric light plant and intend making improvements to the same.

Ft. Des Moines, Ia.—Bids will be received by L. Hardeman, Q. M., U. S. A., Ft. Des Moines, until Nov. 6, for furnishing and installing electric light fixtures, watt meters, and transformers, and wiring for electric lighting in the buildings at Ft. Des Moines, as advertised in The Engineering Record.

Eastport Me.—The Copen Light & Power Co. is reported organized at Eastport with a capital of $10,000, for the purpose of generating and supplying gas and electricity for lighting, heating and mechanical purposes in Perry, Pembroke and Dennysville. Chas. E. Copen, Pres.; Chas. H. Emery, Treas., both of Eastport.

Ellsworth, Me.—The City Council is reported to have taken action which will enable a company, of which W. H. Buhlen, of Boston, Mass., is the head, to build a dam across Union River; the company proposes furnishing power to the industries of Ellsworth, Bar Harbor and vicinity; probable cost of plant proposed, $1,000,000.

South Hadley, Mass.—The Holyoke Water Power Co., of Holyoke, is reported to have petitioned the Selectmen of South Hadley, for permission to erect poles and string wires from Holyoke to South Hadley Center.

Grand Rapids, Mich.—Bids will be received by the Bd. of Public Works (M. Shanahan, Pres.) until Oct. 20 for a direct-connected unit, consisting of engine, alternator and appurtenances, as advertised in The Engineering Record.

Monroe, Mich.—The Bd. of Pub. Wks. is reported to have authorized City Engr. J. W. White to investigate the water power in River Raison, with a view to damning the stream at Dubois farm or Sisters Island, to save expense in the operation of the electric light plant.

Le Roy, Minn.—It is reported that the electric light plant, recently destroyed by fire, will not be rebuilt until spring, but a dynamo will be installed in the mill to furnish electricity for the present.

Belle Plaine, Minn.—It is stated that the Council has voted to install a municipal light plant.

**Duluth, Minn.*—The Great Northern Power Co. is reported to have awarded to the Chicago Bridge & Iron Co., of Chicago, Ill., the contract for the erection of a steel stand pipe 232 ft. high, to be used in connection with its work of developing the water power on St. Louis River.

Atlantic City, N. J.—The City Council is reported to have granted the Atlantic City & Suburban Electric Co. a franchise to supply light, heat and power.

Grand Island, Neb.—The Grand Island Electric Co. is reported incorporated with a capital of $60,000 by Arthur F. Vila, G. H. Payne, Irving F. Baxter and others.

Elko, Nev.—The Intermountain Power Co. is reported incorporated with a capital of $1,500,000 by E. J. Raddats, C. O. Ellingwood and W. J. Craig, to construct a power plant at this place.

New York, N. Y.—Bids will be received at the Bureau Supplies and Accounts, Navy Dept., Washington, D. C., until Oct. 20, to furnish at the Navy Yard, New York, N. Y., 31 motor generators, 2 to 15 kw., 80 to 220 volt; 7 alternating armatures, 2 to 5 kw. H. T. B. Harris, Paymaster Gen., U. S. N.

Bids will be received until Oct. 23 by C. B. J. Snyder, Supt. School Bldgs., for installing electric equipment of addition to and alterations in School 10, Boro Manhattan.

**Brooklyn, N. Y.*—The following are the bids opened Oct. 9 by C. B. J. Snyder, Supt School Bldgs., N. Y. City, for installing electric equipment in the addition to and alterations in School 27, Boro. of Brooklyn: Commercial Constr. Co., 1 Madison Ave., N. Y. City, $6,873 (awarded contract); O. K. Electrical Constr. Co., $9,140, and Griffin & Co., $6,993.

**New Brighton, S. I., N. Y.*—The following are the bids opened Oct. 9 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for installing electric equipment in addition to and alterations in School 23, Boro. of Richmond: Griffin & Co., $4,416; Plymouth Electric Co., $4,885, and O. K. Electrical Constr. Co., 725 Bway, N. Y. City, $4,250 (awarded contract).

Rochester, N. Y.—The Bd. of Supervisors is reported to have adopted a resolution authorizing the Building Comn. to procure an estimate of cost of an electric lighting plant for the court house.

Roseburg, Ore.—The citizens are reported to have voted to issue bonds for water works and an electric light plant.

Albion, Pa.—The question of constructing water works and an electric light plant, is reported under consideration here.

Pittsburg, Pa.—Gen. A. J. Warner, of Gainesville, Ga., who is interested in the construction of power plants to be constructed in Washington County, for the distribution of power in Pittsburg, Wheeling, W. Va., Steubenville, O., and other cities, writes that nothing definite has yet been done in this matter.

Anderson, S. C.—Jos. E. Sirrine, of Greenville, it is stated, has prepared plans for the electric power plant which is to be constructed at Hatton Shoals on Tugalo River, to develop 5,000 hp. for the Hatton Shoals Co., of which R. S. Ligon, of Anderson, is Pres.

Gaffney, S. C.—A company of which J. B. Cleveland of Spartanburg is reported to be the chief promoter, is stated to have a corps of engineers at work making surveys of Gaston Shoals, on Broad River, with a view to developing it for power purposes.

Chattanooga, Tenn.—The contract, together with the $100,000 bond which have been made between the Chattanooga-Tennessee River Power Co. and the Government for the building of the lock and dam power plant on Tennessee River, are reported to have been approved by the War Dept. and returned to Maj. Henry C. Newcomer, U. S. Engr., and are ready for inspection of C. E. James and J. C. Guild, both of Chattanooga, who

Items marked thus give the names of parties awarded contracts.

are reported to be receiving bids. John Bogart, Consulting Engr., New York, N. Y.

San Antonio, Tex.—W. H. McGoldrick, 205 Convent St., San Antonio, is interested in the construction of gas plants at the following places in Texas: San Angelo, to cost $40,000, to be known as the San Angelo Gas Co.; Brownwood, to cost $50,000, to be known as the Brownwood Gas & Electric Co.; Tyler, to cost $30,000, to be known as the Tyler Gas & Electric Co., and at Palestine, to cost $50,000, to be known as the Palestine Gas Co.

Orange, Tex.—The Orange Ice, Light & Water Co. is reported incorporated, with a capital of $60,000, by Sam'l C. Trimble, W. H. Stark and P. B. Curry.

Provo, Utah.—L. L. Nunn, of Provo, Mgr. Telluride Power Co., is reported to have in contemplation the construction of a power plant on the Duchesne for the purpose of furnishing heat and light for Park City, Salt Lake City, Bingham, Mercur, Eureka, Price and other places.

Bellingham, Wash.—Stone & Webster, of Boston, Mass., are reported to have purchased the Nooksack power plant from the Bellingham Bay Improvement Co., and will probably expend about $200,000 in improvements.

Sharon, Wis.—The National Light, Fuel & Gas Co., of Janesville, Wis., it is reported, will establish a municipal gas plant here, to cost about $6,000.

Chatham, N. B.—This town is reported to have voted to apply to Legislature for power to issue $35,000 bonds for the construction of an electric light plant.

Ft. Frances, Ont.—F. H. Warner, Town Clk., writes that nothing definite has yet been done toward constructing an electric light plant for Ft. Frances.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Salinas, Cal.—The Supervisors are stated to have passed an ordinance granting permission to F. M. Hilby to construct, maintain and operate an electric railway over certain routes and highways in Monterey County. J. D. Kalar is clerk.

San Francisco, Cal.—The Street Com. of the Bd. of Supervisors is reported to have voted to recommend the passage of the ordinance granting a franchise to the Ocean Shore Ry. Co., to operate an electric railroad in this city.

East St. Louis, Ill.—The Herrin & Johnson City Ry. Co. is reported incorporated. Capital $10,000. The road is to be constructed from Johnson City to Herrin. Incorporators: L. O. Whitnell, C. M. Forman, H. L. Browning, and others, all of East St. Louis.

Ft. Wayne, Ind.—The Ft. Wayne & Wabash Valley Traction Co. is stated to have decided to extend its line from Robinson Park to Garrett and Auburn.

Wabash, Ind.—The Wabash & Northern Traction Co. is stated to have filed articles of incorporation with the Secy. of State. Capital, $500,000. The road will be a part of the Indiana Northern Traction Co. The company will, in addition to building and operating a line from Wabash to Warsaw, furnish light, heat and power to towns and cities along the line. Dirs., Jas. Barry, Lincoln Gynn.

Marion, Ind.—The Marion & Noblesville Ry. Co is stated to have received a franchise from the Grant County Comrs. for the electric railway to be built from Marion to Noblesville.

Center Point, Ind.—The Town Council is stated to have granted a franchise to the Indianapolis & Ohio Valley Traction Co., which proposes to build from Brazil to Bloomington, as a branch to the main line proposed from Indianapolis to Evansville.

New Castle, Ind.—The Indianapolis, New Castle & Toledo Electric Ry. Co. is stated to have secured a franchise for 50 years. It gives the company the right to build a line of railway from New Castle to the Wayne County line, and from New Castle to the Delaware County line, from Shirley to Anderson and from Maxwell to Greenfield.

Tusla, Ind. Ter.—A street car franchise, granting to Duman F. Parker, of St. Louis, Mo., Geo. E. Johnson, of Shrevesport, La., T. E. Smiley, A. R. Quarry, C. W. Brown and others of Tusla, the right to use the streets of Tusla for electric car purposes, is stated to have passed its first reading in the council. The line will include suburban lines.

Hancock, Md.—F. B. Banister and S. H. Bowman are stated to have been granted a franchise by the County Court of Morgan County, W. Va., to build an electric railway from Berkeley Springs to Hancock.

Springfield, Mass.—The Railroad Comn. is stated to have decided to grant the petition of the Springfield & Eastern St. Ry. Co. to extend its tracks from Monson to Brimfield.

St. Louis, Mo.—The St. Louis, Lakewood & Grant Park Ry. of St. Louis, with a capital of $300,000, is stated to have received a charter to build an electric railway on the south side of the city for a distance of 5 miles. Dir.: F. M. Estes, L. H. Conn, H. H. Waters and others.

Syracuse, N. Y.—The Rapid Transit Co. is reported to have announced that the Bellevue Ave. extension, a loop more than a mile in length, will be built next spring at a cost of $60,000. Supplies will be purchased soon.

Rome, N. Y.—The Rome & Oneida Electric Ry. Co. is reported to have been incorporated to construct a street surface electric railroad 13 miles long from Rome to Oneida. Capital $350,000. Dir.: Dr. T. L. Hill, C. C. Goodwin, New York; E. F. Lally, and G. V. Lally, Detroit, Mich.

East Aurora, N. Y.—Mr. John Boyle, of Utica, is stated to have been granted a franchise to lay tracks through the village streets.

Athens, O.—The Nelsonville, Athens & Gloucester Traction Co. is reported incorporated with $10,000 capital, by J. P. Reynolds, L. F. Carpenter, F. E. Wells, W. J. Stuart, B. C. Wise, Charles Tutt and others. It is proposed to build a line between Nelsonville, Athens and Gloucester.

Nashville, Tenn.—It is stated that work on the Nashville & Franklin Interurban Electric Ry. will begin at once.

Gainesville, Tex.—The Gainesville, Whitesboro & Sherman Ry. Co., G. A. Hassinger, Pres., is stated to have decided to build a line to connect Gainesville, Calisbury, Whitesboro and Sherman.

Baraboo, Wis.—A committee of the Council is reported to have been appointed to confer with N. Wetzel, Pres. of the Dells Co., of Kilbourn, with a view of connecting the Dells of Wisconsin and Devils Lake with an electric railroad. The right of way has already been secured.

St. John, N. B.—It is stated that the Carleton Electric Light Co. is considering the construction of a street railway system.

St. Joseph, Ont.—The St. Joseph & Stratford Electric Ry. Co. is reported organized to build an electric railway fom St. Joseph to Stratford, a distance of 39 miles. The line will pass between Dashwood and Zurich, through Exeter, Rosendale and Fullerton. All plans and profiles have been completed, and the surveys are all made. It is likely that actual construction will be begun within 2 months. N. M. Cantin, of St. Joseph, Mgr.; O. Bissonnett, St. Joseph, Secy.; Thos. Tombyll, Treas.

RAILROADS.

Notes Arranged Alphabetically by States.

Montgomery, Ala.—The Hayneville & Montgomery R. R. Co. is reported incorporated, to build a line from Hayneville to Tyson station, and Montgomery; also from Hayneville to Big Swamp.

Eagle, Alaska.—Wm. Bull, Wm. M. Barnum and Grant D. Schley, of New York, N. Y., and Winthrop Smith, of Philadelphia, Pa., are reported interested in the construction of a railroad from Cadova to Eagle, a distance of about 400 miles.

San Diego, Cal.—The proposed Bay Shore & Pacific R. R. will be a steam road about 30 miles in length and the cost of construction will be $600,000. H. T. Richards, Pres. and Ch. Engr., San Diego.

Denver, Colo.—The Colorado, Wyoming & Idaho R. R. Co. is reported to be preparing to build a line from Denver to Boise, Idaho, by way of Laramie, Wyo.

Atlanta, Ga.—M. T. Edgerton, of Atlanta, Secy. Atlanta & Carolina Ry. Co. writes that bids will soon be asked for the construction of the proposed railroad from Atlanta to Conyers; cost of proposed work, $850,000. M. Mason, Ch. Engr.

Broxton, Ga.—The stockholders and directors of the Douglas, Augusta & Gulf R. R. Co. (B. B. Gray, Mgr. Pinebloom, Ga.), now operating between Nashville via Broxton to Barrows Bluff on Ocmulgee River, are reported to have decided to extend the road northward to Helena and southward to the gulf.

Indianapolis, Ind.—Local press reports state that the agreement for work of separating the grades in the southwestern part of city, under the first resolution that the Bd. of Pub. Wks. adopted in accordance with the law enacted by the last General Assembly, have been completed by the City Attorney. They will be forwarded to the interested railway companies at once, for signatures so that the work may begin. The grade crossings now at Kentucky Ave. and Missouri and West Sts. will be eliminated. Three fourths of the cost will be paid for by the railroads and the remainder will be divided among the city, county and Street Ry. Co. B. J. T. Jeup, City Engr.

Newport, Ky.—The city has now in contemplation the construction of a viaduct or subway to eliminate the grade crossing at the intersection of Monmouth St. with the L. & N. R. R. and C. C. R. R., probable cost $75,000. J. B. Morlidge, City Engr.

Sykesville, Md.—The Baltimore & Ohio R. R. Co. (D. D. Carothers, Ch. Engr., Baltimore) is reported to have a corps of engineers at work on a preliminary survey, which has for its purpose the establishment of a cut-off for through freight to the North and West. The survey is being made from Sykesville on the main line, and will be carried around to Bayview Junction.

Annapolis, Md.—The engineer corps of the Baltimore & Annapolis Short Line R. R. Co. (John Wilson Brown, Pres., Baltimore, Md.) is reported to be making surveys in the vicinity of Annapolis, with the view of straightening some curves.

Santa Fe, N. M.—The Northern New Mexico & Gulf Ry. Co. is reported incorporated by Wm. H. Coxe, New York, N. Y.; Fred C. Coe, Denver, Colo.; Geo. Hill Howard, Santa Fe; G. Volney Howard, Boulder, Colo., and E. F. Miller, of El Rito. The road is to be built from Santa Fe to the New Mexico-Arizona boundary in San Juan County, with a branch road to Durango, Colo. Capital $300,000. Headquarters to be at El Rito, N. M.

Heppner, Ore.—Loehr & Winkle, of Walla Walla, Wash., are reported to be making surveys for a railroad on the Columbia River to timber land and coal mines southwest of Heppner; length of proposed line 80 miles.

**Weatherford, Tex.*—A contract for a road from this point to Bridgeport is reported to have been let by the directors of the Chicago, Weatherford & Brazos Valley R. R. Co. to the McCarthy-Miller Constr. Co.

Cheyenne, Wyo.—The Union Pacific R. R. Co. (John B. Berry, Ch. Engr., Omaha, Neb.) is reported to be making surveys for an additional 75 miles of double tracking in Wyoming. When this is completed, it is stated that the entire track from Cheyenne to Laramie will be double tracked.

**Ft. William, Ont.*—The contract for the construction of the roadbed complete, ready for the ties ad rails, on the Lake Superior branch of the Grand Trunk Pacific Ry., from Ft. William to Lake Superior Junction, about 210 miles, is reported to have been awarded on Oct. 5 to Foley Bros., Larson & Co., of St. Paul, Minn., and Winnipeg, Man.

Montreal, Que.—At the annual meeting of the Canadian Pacific Ry. on Oct. 4, it is stated that a resolution was passed, authorizing the construction of the Wolsley-Reston branch. H. F. Tye, Ch. Engr., Montreal.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Ashdown, Ark.—It is proposed, according to reports, to erect a court house at a cost of about $12,000.

Fresno, Cal.—W. H. Ryan, City Clk., writes that an election will be held Oct. 31 to vote on issuing $75,000 bonds for a new city hall. Architect, Eugene Matheson.

Denver, Colo.—The Union Pacific R. R. (J. B. Berry, Ch. Engr., Omaha, Neb.) it is stated, is contemplating the erection of a hospital in Denver to cost about $50,000.

**Middletown, Conn.*—Contracts for the contagious ward at the Connecticut Hospital for the Insane, it is stated, have been awarded as follows: Mason work, to Horace R. Butler, and joiner work to Gustav Lowenthal, both of Middletown, and fireproof floors to C. W. Kellogg & Son, of New Haven, the total cost of the work amounting, according to reports, to about $15,000.

Washington, D. C.—The following are reported to be the lowest bids received Sept. 30 by Capt. John S. Sewell, Corps Engrs., U. S. A., for excav., grading, cement and concrete work, etc., for Mess Hall, at U. S. Soldiers' Home: Excavating and grading, Matthew Myers, $9,180; Portland cement and hydrated lime, F. Dana Lincoln, $6,591; gravel, broken stone and slate, etc., the Builders' Supply Co., *$5,891; brick, the Laurel Clay Products Co., $11,687.50; laying bricks, the Brennan Constr. Co., $13,172. Bidders all of Washington, D. C.

The following are the bids opened on Oct. 11 at the office of the U. S. Capitol Bldg. and Grounds for furnishing and delivering brick for use in connection with the construction of the Senate and House office buildings: Laurel Clay Products Co., of Washington, bid for 2,000,000 brick, $9.45 per M., to deliver 150 M. per week; Washington Brick & Terra Cotta Co., Washington, D. C., bid $8.60 per M., 210 M. to be delivered per week; Monticello Brick Wks., of Wyoming, Pa., bid $11.80 per M., 35 M. to be delivered per day. Highland Brick Co., Washington, D. C., $7.97 per M., 35 M. to be delivered per day. Standard Brick Co., Washington, D. C., bid $9.79 per M., 200 M. to be delivered per week. Anacostia Brick Co., Anacostia, D. C., bid for 3,000,000 brick $8.65 per M., 100 M. to be delivered per week; Potomac Brick Co., Washington, D. C., bid for 2,000,000 brick, $8.63 per M., 210 M. to be delivered per week; Mack Mfg. Co., Philadelphia, Pa., $14.40 per M., to be delivered as needed.

*It is reported that contracts for the cut stone work required for the new Senate office building have been awarded as follows: Street facades and vestibules only to the Vermont Marble Co., of Proctor, Vt., for $910,000, and for court facades only to Wm. Bradley & Son, 277 Bway, New York, N. Y., for about $136,600.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Jacksonville, Fla.—Local press reports state that City Engr. Prioleau has been authorized to receive bids until Oct. 23 for erecting a city jail.

Caldwell, Idaho.—The county, it is reported, has voted $60,000 bonds to erect a court house.

Chicago, Ill.—Bids will be received until Oct. 17 by the Dept. Pub. Wks. (J. M. Patterson, Comr.) for furnishing material and erecting a 2-story and basement brick and stone fire engine house. Bids to be submitted separately on the following: General work; masonry, etc.; plumbing, electric wiring, etc.; carpentry, etc.; sheet metal, etc.

The directors of the Chicago Lying-In Hospital, it is stated, are contemplating the erection of a new hospital at a cost of about $250,000.

**Taylorville, Ill.*—Theo. Brenkhatter, of Decatur, it is reported, has received the contract to erect the R. C. Hospital at $18,000.

Peru, Ind.—It is stated that competitive plans will be received until Oct. 19 by the Co. Comrs. for a court house. C. W. Macy, Co. Aud.

South Bend, Ind.—It is stated that bids will be received until Oct. 25 by John W. Harbou, Co. Aud., for plumbing, direct and indirect steam heating, electric wiring and electric light fixtures for the new County Infirmary.

Ft. Wayne, Ind.—It is stated that bids will be received until Oct. 25 by J. L. Smith, Co. Aud., for erecting an insane ward, engine house, boiler house and laundry, plumbing and heating at the Allen County Asylum; also for steam heat plant at the Allen County Orphans' Home.

**Des Moines, Ia.*—The Central Htg. Co., it is stated, has secured the contract to heat the new court house.

Marion, Kan.—It is stated that bids will be received until Nov. 9 by the Co. Comrs. for erecting a court house. D. M. McIntosh, Co. Clk.

**Manhattan, Kan.*—C. M. Breese, County Clk., writes that the contract for erecting a court house (bids opened Oct. 5) has been awarded to J. B. Betts, of Topeka, for $45.356.

Ft. Williams, Me.—Bids will be received until Oct. 18 by Capt. A. W. Yates, Q. M., U. S. A., 187 Middle St., Portland, for plumbing a band barrack building at Ft. Williams.

Baltimore, Md.—Dr. Jas. Bosley, Comr. of Health, writes that a site has been secured, and $25,000 appropriated for an infectious disease hospital; money will be available Jan., 1906.

The following ordinances have been reported favoraably by the Com. of Fire Dept. and referred to the Bd. of Estimates: appropriating $30,000 for the purchase of a site and the erection of an engine house in the vicinity of Caroline St. and Eastern Ave.; $25,000 for the purchase of a site and the erection of a truck house in the vicinity of Pratt and Calhoun Sts.; $23,500 for the purchase of a site and the erection of an engine house in the vicinity of Kate Ave. and Reisterstown Road.

Springfield, Mass.—Bids will be received until Oct. 24 by the Bd. Co. Comrs. (W. H. Brainerd, Chmn.) for erecting a Hall of Records; also same date for ventilating and heating said building.

Springfield, Mass.—It is stated that it is proposed to erect a nurses' home at the Springfield Hospital, to cost about $18,000. Geo. Dwight Pratt, Pres. Bd. Trus.

Minneapolis, Minn.—It is stated that the erection of an administration building at the city hospital, to cost about $60,000, is under consideration.

A Bd. of Trus., it is stated, has been appointed, of which Rev. T. H. Dahl, Pres. of the United Norwegian Lutheran Church, is a member, to have charge of a Norwegian Hospital, which it is proposed erecting here at a cost of about $200,000.

Items marked thus give the names of parties awarded contracts.

St. Paul, Minn.—It is stated that the Park Bd. has decided to reject all bids received Oct. 2 for erecting the Como Park pavilion, and to do the work itself. The lowest bid received was from W. A. Cameron, at $49,300.

The Bd. of Aldermen, it is stated, has decided upon a site on 4th St., near Franklin Ave., on which it is proposed erecting the auditorium.

Jefferson City, Mo.—The Comrs., it is stated, have selected a site in the Ozarks in the southwestern part of Lawrence County, on which it is proposed erecting the State Sanitarium for the treatment of tuberculosis, for which the legislature appropriated $50,000.

Columbia, Mo.—It is reported that the citizens have voted in favor of issuing $100,000 bonds to erect a court house.

Newark, N. J.—The following are reported to be the lowest bids received Oct. 4 for erecting truck house No. 7 on Park Ave. and N. 6th St.; Masonry and stone work, J. Allen Conklin, $9,638; carpenter work and painting, Wm. G. Sharwell, $6,889; plumbing, Storms & Co., $696; heating, Elias Berla, $619; electric lighting, Harry R. Jackson, $398; total, $18,240.

*_Jersey City, N. J._—Tierney & Connelly Constr. Co., it is stated, secured the contract for erecting engine house No. 17 at $10,884, and J. Jewkes & Sons Co., the contract for truck house No. 7 at $12,843.

Newark, N. J.—Bids will be received until Oct. 20 by the Com. on Pub. Bldgs., Co. Bd. Chosen Freeholders (Hugh Gallagher, Chmn.) for furnishing material for the plumbing and other work on the west wing at the Essex Co. Prison.

New York, N. Y.—Bids were opened on Oct. 5 by the Comrs. of Parks for furnishing material and installing fire lines, sprinkler system, fire escapes and kalamein doors for the American Museum of Natural History. The bids received were as follows: (_a_) for all work complete; (_b_) deduct amount if automatic sprinklers are omitted; (_c_) deduct amount if fire escapes are omitted; (_d_) deduct amount if kalamein doors are omitted: Thos. Cockerill & Son, 147 Columbus Ave., _a_ $44,500, _b_ $5,000, c $1,000, d $1,000; Ralph J. F. Gerstle Co., 341-7 E. 44th St., _a_ $19,838, _b_ $5,600, _c_ $1,300, _d_ $2,000; J. N. Knight & Son, 221 W. 49th St., _a_ $27,800, _b_ $5,250, _a_ $2,500, _d_ $1,270; John R. Sheehan & Co., Inc., 160 5th Ave., _a_ $26,400, _b_ $5,500, _c_ $2,500, _d_ $1,300; Louis Wechsler, 1133 Bway, _a_ $21,000, _b_ $5,000, _c_ $1,500, _d_ $1,200.

Bids will be received until Oct. 17 by the Dept. Pub. Charities (Jas. H. Tully, Comr.) for furnishing material and erecting the municipal lodging house on E. 25th St., near Ave. A.; est. cost, $150,000. Raymond F. Almirall, Archt., 51 Chambers St.

A resolution has been approved by the Mayor, authorizing an appropriation of $159,000, providing $125,000 for erecting brick buildings, accommodations for the officers, shops. wagon houses, stables and sheds, etc., and $34,000 for excavating 12,000 cu. yds. earth, 3,900 cu. yds. filling, 3,000 cu. yds. rubble masonry in mortar, 1,200 cu. yds. concrete, 650 lin. ft. 12-in. drain and 5,800 sq. yds. block pavement; said work to be done on property at Webster and Park Aves., north and south of E. 181st St., acquired by the city for general yard purposes.

Brooklyn, N. Y.—Bids will be received until Oct. 26 by the Park Bd. (John J. Pallas, Pres.), New York City, for furnishing material and installing hot water heating apparatus in greenhouses in Prospect and Forest Parks, and alterations in steam heating plant, Litchfield Mansion, Prospect Park, Boro. Brooklyn.

Carmel, N. Y.—John W. Towner, Clk. of Supervisors, writes that no contract was let on Oct. 9 for alterations to county jail and court house. It is proposed to advertise, but no date has been set as yet for the receiving of new bids.

Kingston, N. Y.—It is stated that plans and specifications have been received by Capt. Everett Fowler for the improvements which it is proposed making to the armory at a cost of about $30,000.

*_Ft. Michie, N, Y._—Capt. O. W. Bell, Q. M., U. S. A., New London, Conn., writes that the lowest bid opened on Oct. 6 for erecting a hospital at Ft. Michie was submitted by E. J. Sica, of Fishers Island, for $23,704.

Ft. Totten, Willets Point, N. Y.—Bids will be received by Capt. Geo. H. McManus, Constructing Q. M., U. S. A., until Oct. 24, for plumbing one double set officers' quarters at this post, as advertised in The Engineering Record.

New Brighton, S. I., N. Y.—Bids will be received until Oct. 24 by Geo. Cromwell, Pres. Boro. Richmond, for furnishing labor and material for the plumbing, heating, tiling, mason, carpenter and electric work required for the court house at Richmond, Boro. Richmond, New York City. Wm. H. Mersereau, 52 Bway, N. Y. City.

Plattsburg Barracks, N. Y.—Capt. T. B. Lamoreux, Q. M., U. S. A., Burlington, Vt., writes that the following are the lowest bids opened on Oct. 7 for constructing an addition to the post hospital at Plattsburg Barracks: construction, Pennington & Butler, of Plattsburg, for $10,883; heating, Breen Bros., Utica, and plumbing and gas piping, T. Costello, Plattsburg.

Fargo, N. D.—It is stated that all bids recently received for erecting the city hall have been rejected. Bowers Bros., it is stated, submitted the lowest bid for erecting the building at $19,198, and E. J. Harrington the lowest bid for plumbing, heating and ventilating the same at $1,973.

Akron, O.—The City Council, it is reported, is considering an ordinance to issue $125,000 bonds for erecting a city hall.

Cleveland, O.—It is stated that the plans for the county court house have been submitted to the Co. Comrs. by Lehman & Schmitt, Garfield Bldg., for approval. It is stated that the cost is estimated at $3,678,000 if granite is used.

Columbus, O.—The erection of a new state prison, at a cost of about $2,000,000, is reported under consideration.

*_Scranton, Pa._—Mark K. Edgar, Dir. Dept. Pub. Safety, writes that the contract for erecting an addition to the City Hall (bids opened Oct. 9) has been awarded to Mathias Stepp, Bd. of Trade Bldg., for $49,975.

Pittsburg, Pa.—The Pub. Safety Com. of the Councils, it is stated, has approved the ordinance appropriating $23,000 for the erection of an engine house in the 18th Ward, to also accommodate a hook and ladder company.

*_Williamsport, Pa._—Edwin Gilbert & Co., of Philadelphia, it is stated, have secured the contract to erect a library for the J. V. Brown estate, the cost to be about $125,000.

Pittsburg, Pa.—The Bd. of Directors of the Mercy Hospital, it is stated, has been granted permission to erect a 3-story brick and iron fireproof building, to cost about $50,000.

Chattanooga, Tenn.—The City Council, it is stated, has passed an ordinance authorizing the Mayor to purchase a lot on 11th St. on which it is proposed erecting a city hall.

Temple, Tex.—The Santa Fe R. R. Co., it is reported, is contemplating the erection of a hospital here to cost about $100,000. Marshal R. Sanguinet, of Ft. Worth, is the Archt.

Norfolk, Va.—It is stated that improvements to the central fire station, to cost about $11,000, are contemplated.

Richmond, Va.—It is stated that the Co. Comrs. intend erecting a $50,000 jail.

Ft. Wright, Wash.—Bids will be received until Oct. 30 by Capt. Edw. A. Shuttleworth, Q. M., U. S. A., for construction and plumbing a fire station at this post.

Spokane, Wash.—It is stated that the contract for the superstructure of the armory will be awarded next spring.

*_North Yakima, Wash._—Wilbur Crocker, Deputy County Aud., writes that the contract for erecting a fireproof court house (bids opened Sept. 2) has been awarded to W. W. Felton, of North Yakima; the building complete will cost $85,000.

*_Fayetteville, W. Va._—The Van Dorn Iron Wks., of Cleveland, O., it is reported, have received the contract to erect a stone jail with 36 cells at a cost of $42,000.

*_Montreal, Que._—J. Bourque, of Hull, it is reported, has received the contract to erect the postal substation on St. Catherine St. W., at about $57,400.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

*_Huntsville, Ala._—Garrity & Hahn, of Chattanooga, Tenn., it is stated, have received the contract to erect the Elks theatre and home, at a cost of $75,000.

*_Little Rock Ark._—G. H. Johnson, of St. Louis, Mo., it is reported, has received the contract to erect the Majestic Theatre, at a cost of $40,000.

Los Angeles, Cal.—It is reported that the International Savings & Exchange Bank intends erecting a 10-story fireproof bank and office building to cost about $150,000.

R. A. Rowan and A. C. Bilike, it is reported, are members of a company which proposes erecting a 10-story building here to cost about $450,000.

*_Long Beach, Cal._—It is reported that the contract to erect a building for the National Bank, of Long Beach, has been awarded to Alpeters, Hall & Alpeters, of Los Angeles, at a cost of $125,000.

*John C. Austin, of Los Angeles, it is stated, has secured the contract to erect a hotel here to cost about $200,000.

Denver, Colo.—W. C. Mead, of the Denver Water Co., writes that bids will be opened about Oct. 20 for the construction of a business building at California and 16th Sts., to cost about $35,000. Architects, Marean & Norton, Dodge Bldg.

Indianapolis, Ind.—See "Power Plants, Gas and Electricity."

Indianapolis, Ind.—Albert Gall, it is reported, has ordered plans prepared for a 6-story business building, which he proposes erecting on E. Washington St.

Chickasha, Ind. Ter.—The business men of the city, are said to be interested in the erection of a $50,000 hotel here.

*_Des Moines, Ia._—Benson & Marxer, 425 Grand Ave., it is stated, have secured the contract to erect a 4-story, 50x120 ft., building at 10th and Cherry Sts., for the National Biscuit Co., Probable cost, $60,000.

Ottawa, Kan.—The Bldg. Com. of the Y. M. C. A., it is reported, has been authorized to erect a building to cost $30,000.

New Orleans, La.—It is stated that plans are being prepared for enlarging the Elks Home, and as soon as plans have been completed bids for the construction will be asked. Probable cost of work $50,000.

It is stated that bids will be received until Oct. 25 by the Bldg. Com. (Chas. Godchaux, Chnm.) for erecting the Y. M. C. A. auditorium. Stone Bros., 818 Common St., and Emile Weil, 219 Carondelet St., assoc. archts.

*_Baltimore, Md._—Simonsin & Pietsch, Hoen Bldg., it is stated, have been commissioned to prepare plans for the garage which is to be erected at Maryland and Mt. Royal Aves., at an estimated cost of $150,000. It is reported that the Geo. A. Fuller Co., of N. Y. City, N. Y., is to secure the contract for constructing same.

*Wells Bros., of N. Y. City, N. Y., it is stated, have secured the contract to erect a garage for the Mar-Del Mobile Co., at Mt. Royal Ave. and Charles St.

Fall River, Mass.—Jos. M. Darling, 78 Bedford St., is stated to have been selected to prepare plans for an addition to the Boys Club House. Thos. Chew, Secy.

*_Worcester, Mass._—Norcross Bros. Co., 10 E. Worcester St., have secured the contract for erecting a stone bank building for the Worcester County Institution for Savings on Main and Foster Sts.; cost $40,000.

*_Boston, Mass._—It is reported that Whidden & Co., 43 Milk St., have received the contract to erect a 5-story mercantile building at a cost of $25,000.

*_Detroit, Mich._—J. W. Sheldon, it is stated, has secured the contract to erect a mausoleum in Woodlawn Cemetery for Merrill B. Mills, and the Venetian Marble Mosaic Co., the contract for the mosaic work. The total cost, it is reported, is to be about $25,000. Louis Kamper, Goebel Bldg., is the Archt.

Saginaw, Mich.—John Carrigan, 211 Genesee St., it is stated, has prepared plans for an audiaorium, which is to be erected on Lapeer Ave. and Weadock St. by the Auditorium Amusement Co., of which Ben G. Appleby is a member.

St. Paul, Minn.—The Elks, it is stated, have purchased a 3-story building at S. Washington and 4th Sts., and will remodel and erect additions to the same at a total cost of about $50,000.

Kees & Colburn, of Minneapolis, it is stated, are preparing plans for a 3-story brick and terra cotta theatre which is to be erected for the Orpheum circuit at 5th and St. Peter Sts., at a cost of about $150,000.

It is reported that G. J. Grant, 61 E. 9th St., has secured the contract to erect a 5-story building for Nicolls, Dean & Gregg at a cost of about $150,000.

Minneapolis, Minn.—It is stated that the members of the Phœnix Club have accepted the plans prepared by Bell & Detweiler, of Minneapolis, for the 2-story brick club house which it is proposed erecting at Hennepin and Laurel Aves., at a cost of about $15,000.

Jackson, Miss.—The Norvelle Hotel, it is stated, was destroyed by fire on Oct. 2. It is reported to be the purpose of the owners to rebuild and enlarge the structure, at a cost of about $125,000.

The Knights of Pythias are reported to be arranging to erect a hall, etc., to cost about $25,000. Address H. M. Quinn, Secy.

Starkville, Miss.—The Masons, it is reported, have decided to erect a 4-story building to cost about $16,000.

St. Louis, Mo.—The directors of the Baptist Orphans' Home, it is stated, are considering the erection of a new building to cost about $40,000. Mrs. W. B. Harrison, Corresponding Secy.

Kansas City, Mo.—It is reported that about $350,000 is to be expended by the owners of the Hotel Baltimore, which will include the erection of a 9-story addition.

Harrison, N. J.—Chas. P. Baldwin, of Newark, it is stated, has prepared plans for a 3-story brick store, office and storage building, which is to be erected on Harrison Ave. for John O'Connor; estimated cost, $20,000.

Newark, N. J.—The Central R. R. of New Jersey (J. O. Osgood, Ch. Engr., Jersey City), it is stated, has secured a permit to erect a 6-story storage warehouse at Mechanic, Lawrence and Ward Sts., at an estimated cost of $500,000. The John W. Ferguson Co., of Paterson, are the Archts.

*_Brooklyn, N. Y._—Peter Clarey, of Brooklyn, it is stated, has secured the contract to erect a 5-story addition to the building of the Society for the Prevention of Cruelty to Children. Cost reported to be about $57,000.

*_Cadiz, O._—E. M. Long & Sons, of Cadiz, it is reported, have secured the contract to erect the Fourth Natl. Bank Bldg., at a cost of about $30,000.

Toledo, O.—Geo. S. Mills, Gardner Bldg., it is stated, is preparing plans for a 10-story hotel which is to be erected at Jefferson Ave. and Superior St., at a cost of about $500,000, by the Commonwealth Bldg. Co.

Cincinnati, O.—The Mason of this city, it is reported, are contemplating the erection of a building to cost about $1,000,000. R. E. Lee is Chmn. of the Com.

Cleveland, O.—The directors of the Utopian Club., it is stated, are contemplating the erection of a clubhouse, probably on Willson Ave., to cost about $100,000.

It is reported that plans have been completed for the car barn which is to be erected by the Cleveland Electric Ry. Co. (E. J. Cook, Ch. Engr., Electric Bldg.) at a cost of about $150,000. It is reported that contracts on some parts of the building have been awarded and that other contracts are to be awarded shortly.

Knox & Elliot, Mercantile Bank Bldg., it is stated, are preparing plans for the $2,000,000 hippodrome which is to be erected on the Union Club site.

John D. Rockefeller, it is stated, is considering the erection of a building for the Cleveland Humane Society, at a cost of about $50,000.

Portland, Ore.—It is stated that plans are to be prepared by Emil Schact, 318 Commercial Bldg., for a 6-story office building which is to be erected by Capt. Buchanan, at Washington and 4th Sts., next spring.

With regard to the proposed Wells Fargo Building, for which it was reported in the last issue of The Engineering Record, that plans for the superstructure would be ready for contractors about Oct. 20, we are informed that contracts are to be let direct on all trades by the company, through the architect, Benj. Wister Norris, Jr., 5 W. 31st St., New York, N. Y., there being no general contractor. Bids are now being taken on the foundation work which will consist of concrete piers running to hard pan with a reinforced concrete floor thoroughly waterproofed on the bottom and sides, forming a water-tight box to withstand a possible upward pressure of about 1200 lbs. Superstructure will consist of the ordinary steel frame with curtain walls, being limestone the first 3 stories and brick and terra cotta above. The building is on a plot 100x100 on the corner of 6th and Oak Sts., Portland, 12 stories high. There will be 3 high-speed electric passenger elevators, machinery of same on roof, being impossible to place electric motors in the cellar because this portion of Portland has been known to be flooded 3 feet deep over the sidewalk at certain times, due to the backing up of the Columbia and Willamette Rivers, and there will therefore probably be no generating plant in the building, only a low-pressure steam-heating apparatus.

Braddock, Pa.—E. J. Carlisle & Co., Westinghouse Bldg., Pittsburg, it is stated, are preparing plans for a brick store and apartment building for Katz & Goldsmith on Braddock Ave. and 7th St., to cost $40,000.

McKeesport, Pa.—H. J. Lohman, of McKeesport, it is stated, is preparing plans for a 4-story manufacturing plant and a 1-story addition to the warehouse for the Watson Paint & Glass Co., at 406 Ringgold St. Probable cost $30,000.

Wilkinsburg, Pa.—It is reported that bids are being received by Thos. W. Boyd & Co., Archts., Smith Blk., Pittsburg, for a brick hotel which is to be erected here for O. P. Smith at a cost of $100,000.

*_Philadelphia, Pa._—It is stated that a contract has been awarded to Doyle & Doak, 1509 Sansom St., for a 12-story warehouse, 94 x 141 ft., to be erected at 2nd and Spruce Sts., for Mary L. Coleman and Katherine C. Bonner; cost, $75,000.

Pittsburg, Pa.—The Walther-Robertson Drug Co., it is reported, has commissioned F. C. Sauer, 804 Penn Ave.,

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Items marked thus give the names of parties awarded contracts.

to prepare plans for an 8-story fireproof brick and steel warehouse, to cost about $80,000.

W. A. Thomas, Park Bldg., it is stated, is preparing plans for a brick block to be erected for Morgan Bros. at a cost of $50,000.

**Pittsburg, Pa.*—W. F. Trimble & Sons Co., of Allegheny, it is stated, have secured the contract to erect a 900 x 45 ft. inbound freight warehouse, at the Point Terminal of the Duquesne Way elevated of the Pennsylvania R. R. The total cost, it is reported, will be about $500,000.

Homestead, Pa.—The B. P. O. E. Lodge, No. 650, it is reported, intends erecting a clubhouse on 8th Ave., to cost about $25,000. M. Hope Scorer may be able to give further information.

**Slatington, Pa.*—J. P. Van Kirk, of Paterson, N. J., is stated to have secured the contract for erecting a 3-story addition, 53x130 ft., to the silk mill at Slatington, owned by the Post & Sheldon Corp., of Paterson, N. J.

Charleston, S. C.—Dr. J. F. Ensor, it is reported, contemplates erecting a hotel at Hyatt Park, to cost about $100,000.

Knoxville, Tenn.—The Swepson estate, it is stated, is contemplating the erection of a business building on Commerce Ave., to cost about $35,000.

Memphis, Tenn.—The members of the Memphis Hotel Co., it is stated, have accepted the plans prepared by Shaw & Pfeil, Planters' Bldg., for the 9-story addition to Hotel Gayoso, and it is reported that bids for the construction will be opened about Nov. 1. J. S. Aisthorp, Secy. of the company.

**Galveston, Tex.*—H. D. McCoy, of Cleburne, it is stated, has received the contract to erect an extension to the roundhouse of the Gulf, Colorado & Santa Fe R. R., to cost approximately $30,000.

Salt Lake City, Utah.—J. Neuhauser, 528 Dooley Blk., is stated to have prepared plans for a 3-story brick building for the I X L Furniture Co., to be erected on 3d, South and Main Sts., to cost about $40,000.

Spokane, Wash.—The American Steam Laundry Co., it is stated, is preparing to erect a laundry at 2d Ave. and Madison St., to cost about $30,000.

*The Trussed Concrete Steel Co., of Detroit, Mich., it is stated, has secured the contract to erect the main building, a 6-story reinforced concrete structure, 150x142 ft., on Howard St., for the Holley-Mason Hardware Co., the cost to be about $145,000. Fred. Phair, 1723 Jefferson St., it is stated, secured the contract to erect a 1½-story building, 100x132 ft., for the same company at a cost of $16,000.

Sheboygan, Wis.—It is stated that plans have been completed for the $75,000 depot which the Chicago & Northwestern R. R. (E. C. Carter, Ch. Engr., Chicago, Ill.) intends erecting here.

Madison, Wis.—The Chicago & Northwestern R. R., it is stated, intends erecting a freight depot here to cost about $70,000. E. C. Carter, Ch. Engr., Chicago, Ill.

New York, N. Y.

519 E. 13th St., 6-story br. and stone store and tenemt.; c, $25,000; o, Julius Tishman; a, E. H. Meyer.

439 E. 71st St., 6-story br. and stone store and tenemt.; c, $226,500; o, David Leuten; a, Geo. F. Pelham.

324 E. 125th St., 2 6-story br. and stone store and tenemts; total c, $70,000; o, Morris D. Dubinsky; a, Horenburger & Straub.

144th St. and 8th Ave., 6-story br. and stone store and tenemt.; c, $50,000; o, Raphael Kurzrok; a, Horenburger & Straub.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

San Francisco, Cal.—It is reported that the Advisory Com. of the St. Philipps R. C. Church has decided to erect a church and parsonage to cost $25,000.

**Athens, Ga.*—The contract for remodeling the Presbyterian Church at Athens has been awarded to Fred. Wagener, of Atlanta, for $15,000.

Chicago, Ill.—J. Youngberg, 218 La Salle St., is preparing plans for 2 apartment houses which are to be built at 48th St. and Kenwood Ave. for Wm. S. Reed. Each of these buildings will be 3 stories high, 60x110 ft., and cost a total of about $100,000.

Nelson & Lewin, the builders, will erect an apartment building at Rokeby St. and Sheridan Road after plans by Wm. J. Van Keuren, 119 La Salle St. It will be 3 stories high, 50x95 ft., and cost $75,000.

Krietenstein Bros., the builders, have had plans prepared for a 3-story apartment building, 100x118 ft., to be built at Hazel St. and Galt Ave., at a cost of $65,000.

**Mansfield, Ill.*—The Mills Lumber Co., of Decatur, it is reported, has received the contract to erect a residence here for Chas. W. Fairbanks at a cost of $35,000.

New Orleans, La.—A building permit, it is stated, has been granted to the Sisters of the Congregation of St. Joseph, to erect a 2-story brick convent on Ursuline St., at a cost of $40,000.

Baltimore, Md.—The congregation of the Lutheran Church of the Incarnation, it is stated, has selected a site at Madison and North Aves. on which it is proposed erecting an edifice to cost about $40,000. It is reported that no architect has been selected as yet. Rev. A. H. Studebaker, Pastor.

The congregatio nof the Highland Methodist Episcopal Church, it is stated, is contemplating the erection of an edifice to cost about $20,000.

Pontiac, Mich.—Rev. T. Gavin Duffy, Rector of All Saints' Episcopal Church, it is reported, is contemplating the erection of a new edifice at a cost of $40,000.

**Albert Lea, Minn.*—Tapager & Hanson, of Albert Lea, it is stated, have secured the contract to erect the First Baptist Church at $12,000.

**St. Paul, Minn.*—It is stated that a building permit has been issued for a 3-story brick flat which is to be erected at 6th St. and College Ave., at a cost of $20,000. Wm. G. Strickland, owner; St. Paul Bldg. Co., 209 W. 5th St., contractor.

Minneapolis, Minn.—C. D. Velie proposes erecting a 2-story brick and stone dwelling at 225 Clifton Ave., to cost $30,000.

J. S. Hewson will erect a $10,000 dwelling at 2008 Pillsbury Ave.

Kansas City, Mo.—It is stated that improvements are to be made to the Central Presbyterian Church at a cost of $15,000. Rev. S. M. Need, Pastor.

**Newark, N. J.*—Fissell & Wagner, of New York, N. Y., it is stated, have secured the contract to erect a 3-story residence and stable at 496 Mt. Prospect Ave., for Jos. G. Spurr, at a cost of about $30,000.

A building permit has been granted to the Y. M. C. A., owner, to make alterations to dwellings at 107-111 Halsey St., the cost to be about $26,000.

New York, N. Y.—Plans have been filed for alterations to be made to the home of Cornelius N. Bliss, at 29 E. 37th St., the cost to be $30,000. F. H. Bosworth, Jr., Archt., 1170 Bway.

Statesville, N. C.—The Methodists, it is stated, are planning the erection of an edifice to cost about $20,000.

Shawnee, Okla. Ter.—The members of the Reformed Church, it is stated, intend erecting an edifice at a cost of about $20,000.

Pittsburg, Pa.—Isaac W. Jenks, of the Carnegie Steel Co., it is stated, has approved plans for alterations to be made in the residence on Beechwood Ave., 22d Ward, the cost to be about $12,000.

*Henry Shenk, Lewis Blk., it is stated, has received the contract to erect a brick, stone and terra cotta residence on Irwin Ave., to cost $25,000.

Greensburg, Pa.—Beezer Bros., of Pittsburg, it is stated, have completed plans for a brick and stone stable and coachman's apartments for Lloyd B. Huff, the cost to be $30,000.

Scottdale, Pa.—Allison & Topp, of Pittsburg, it is reported, are preparing plans for a stone church for the First Baptist Congregation, which will probably cost $30,000.

McKeesport, Pa.—Henry J. Linderman, of McKeesport, it is stated, has prepared plans for a brick veneered edifice for the Swedish M. E. Church, to cost about $20,000.

Philadelphia, Pa.—Jas. Johnston, it is stated, has filed plans for an edifice for the Wharton St. M. E. Church, to be erected at 54th and Catharines Sts., the cost to be about $80,000.

Memphis, Tenn.—The congregation of the First Baptist Church, it is reported, has decided to erect a new edifice at a cost of $60,000.

Nashville, Tenn.—The Bldg. Com. of the McKendree Church, of which Percy D. Maddin is a member, it is stated, is considering the building of the edifice. Dr. E. B. Chappell, pastor.

**Keyser, W. Va.*—McIver & Piel, of Baltimore, Md., it is reported, have secured the contract to erect a stone church here to cost about $15,000.

Milwaukee, Wis.—The members of the Kingsley M. E. Church, it is stated, are contemplating the erection of a new edifice on the present site at 29th and Brown Sts., to cost about $25,000. Rev. W. D. Cox, Pastor.

New York, N. Y.

14 Cherry St., 6-story br. and stone tenemt.; c, $50,000; o, Union Constr. & Realty Co.; a, Bernstein & Bernstein.

76th St. and Ave. A, 6-story br. and stone tenemt.; c, $50,000; o, Dr. D. Feigensohn; a, Bernstein & Bernstein.

79th St. and Ave. A, 6-story br. and stone tenemt.; c, $55,000; o, Geiger & Browerman; a, Geo. T. Pelham.

326 E. 116th St., 6-story br. and stone tenemt.; c, $45,000; o, Empire Cornice Works; a, Bernstein & Bernstein.

Manhattan Ave. and 110th St., 6-story br. and stone tenemt.; c $54,000; o, Eden Constr. Co.; a, Clarence L. Sefert.

Hamilton Pl. and 139th St., 2 6-story br. and stone tenemts.; total c, $120,000; o, Miller Realty Co.; a, House & Sloan.

157th St. and Amsterdam Ave., 5-story br. and stone tenemt.; c, $45,000; o, David Miller; a, Stern & Morris.

176th St. and Amsterdam Ave., 4 5-story br. and stone tenemts.; total c, $70,000; o, Perlman & Bernikon; a, Wm. C. Scmmerfeld.

177th St. and Amsterdam Ave., 6 5-story br. and stone tenemts.; total c, $210,000; o, Perlman & Bernikow; a, Wm. C. Scmmerfeld.

172 St. and Amsterdam Ave., 3 5-story br. and stone tenemts.; total c, $135,000; o, Libman Horowitz; a, Bernstein & Bernstein.

8th Ave. and 154th St., 3 6-story br. and stone tenemts.; total c, $125,000; o, Roosevelt Realty & Constr. Co.; a, Benj. Steckler.

Belmont St. and Monroe Ave. 2 5-story br. tenemts.; total c, $90,000; o, Bernard Badams; a, Vincent Bonagur.

137th St. and Cypress Ave., 2 5-story br. tenemts.; total c, $60,000; o, Max Rosenbaum; a, John Hauser.

137th St. and Cypress Ave., 2 5-story br. tenemts.; total c, $60,000; o, Economy Bldg & Realty Co.; a, John Hauser.

Morris Ave. and 158th St., 6-story br. tenemt.; c, $60,000; o, Bronxland Realty Co.; a, Harry T. Howell.

Union Ave. and 165th St., 2 5-story br. tenements.; total c, $85,000; o, Ole Ilsson; a, Moore & Landsiedel.

SCHOOLS.

Notes Arranged Alphabetically by States.

Yuma, Ariz.—Bids will be received by John S. Spear, Supt. Ft. Yuma School, for furnishing and delivering about 67,787 ft. lumber, 97,600 shingles, 10,000 lath, 2,000 brick, 29 bbls. cement, 1,300 lbs. iron, 3,500 ft. corrugated iron, 1 filter, capacity 20,000 gal.; 1 tank, capacity 20,000 gal., etc.

Claremont, Cal.—It is reported that a $40,000 library is to be erected at Pomona College. Geo. A. Gates, Pres.

Killingly, Conn.—It is reported that at the town meeting Oct. 2 it was voted to issue $50,000 bonds for the erection of a high school.

**New Haven, Conn.*—The Sperry & Treat Co., 39 Church St., are the general contractors for the dormitory to be erected for Yale Univ., to cost $200,000. It will be 4 and 6 stories, of brick, stone and iron, 116 x 50 ft. Architect, C. C. Haight. Sperry & Treat Co. are also contractors for the 2-story brick and stone addition to Yale Infirmary on Prospect St., to cost $15,000. Architect, Louis De Coppet Bergh.

Gainesville, Fla.—The Florida Education Bd. of Control, it is stated, has selected Edwards & Walter, of Columbia, S. C., as the supervising archts. for the building to be erected at the Univ. at Gainesville.

Warrenton, Ga.—The citizens, it is statedl have voted in favor of issuing bonds for school purposes. It is reported that it is proposed to erect a $10,000 brick building.

Rockford, Ill.—It is stated that the Council is considering the appropriating of $100,000 for the erection of a high school.

**Saugus, Mass.*—W. Geo. Greenlay, it is stated, has secured the contract to erect a 4-room school on Lincoln Ave., at $12,609.

**Westfield, Mass.*—L. H. Scott & Co., it is stated, secured the contract for erecting an addition to the high school, and W. J. Hyland the contract for the ventilating and heating plant for same. Appropriation, $30,000. Contractors of Westfield.

**Holyoke, Mass.*—Louis A. Lafrance, it is stated, has the contract for erecting a school in South Holyoke, at $56,193; Patrick J. Donnelly, the contract for ventilating and heating same at $6,045, and Sparrow & McTigue, the contract for plumbing at $2,968.

**Minneapolis, Minn.*—The Bd. of Educ., it is stated, has awarded the contract for installing a ventilating and heating plant in the Lincoln School to the Andrews Htg. Co., at $5,874, and the contract for the ventilating and heating plant in the Hiawatha School to H. Kelly & Co., at $1,900.

Kansas City, Mo.—The Cathedral Parish, it is stated, intends erecting a college to be known as St. John's Academy, the cost to be about $400,000. Bishop John J. Hogan may be able to give further information.

**St. Edward, Neb.*—The Bd. of Educ., it is stated, has awarded the contract to erect an addition to the school to J. J. Jensen, of St. Edward, and the contract for the steam heating plant for same to A. Dussell & Son, of Columbus, Neb., the combined bids, its is reported, amounting to $10,464.

**Berlin, N. H.*—The contract to erect the high school, it is stated, has been awarded to Craig & Russell, of Berlin, at $32,650, and the contract for the ventilating, heating and plumbing for same to C. H. Goss & Co., of St. Johnsbury, Vt., at $5,226.

New York, N. Y.—Plans have been filed for a 5-story brick and stone school, to be erected at 4th St. and 1st Ave., for the City of New York, at a cost of $70,000. C. B. J. Snyder, Archt., 500 Park Ave.

New York, N. Y.—The Bd. of Estimate, it is stated, has recommended the issue of $3,000,000 bonds for school sites and buildings.

Brooklyn, N. Y.—Bids will be received until Oct. 23 by C. B. J. Snyder, Supt. School Bldgs., New York City, for installing ventilating and heating apparatus for new School 149, Boro. Brooklyn; also School 87, Middle Village, Boro. Queens.

Sag Harbor, L. I., N. Y.—Mrs. Russell Sage, it is reported, has donated $75,000 toward the erection of a school here.

Jamestown, N. D.—Bishop Shanley, it is stated, has approved the plans prepared by Hancock Bros., of Fargo, for the additional building at St. John's Academy, which is to cost about $30,000.

**Grandville, O.*—W. C. Handschy, of Zanesville, it is stated, has secured the contract to erect the Barney Science Hall at Dennison Univ., Grandville, at a cost of about $55,000.

Wooster, O.—Pres. Holden, of Wooster Univ., it is stated, has announced that H. C. Frick, of Pittsburg, Pa., intends erecting an addition to the Frick Memorial Library. It is estimated that the cost will probably be $40,000.

Shawnee, Okla. Ter.—It is reported that a site has been selected and a normal school is to be erected at a cost of $65,000.

Philadelphia, Pa.—An amended ordinance has passed both branches of the Council, appropriating $353,000 for the purchase of ground, property and the erection of a building for the Commercial High School for Girls.

Laredo, Tex.—It is reported that the citizens have voted to appoint a committee to bring the question of issuing $40,000 bonds for the erection of a school before the Bd. School Trus.

Bethany, W. Va.—It is proposed to erect a $20,000 Carnegie Library at Bethany College. T. E. Cramblett, Pres.

**Omro, Wis.*—J. E. Mallery, of Oshkosh, it is stated, has secured the contract to erect the Webster Manual Training School at Omro, a 3-story and basement brick structure.

Wauwatosa, Wis.—Van Ryn & DeGelleke, of Milwaukee, it is stated, have prepared plans for a school to be erected in the joint district of Wauwatosa and Greenfield, to be built during the winter.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—The question of constructing a crematory for the disposition of trash, is reported under consideration here.

**Bridgeport, Conn.*—Dr. Elmer F. Blank, Pres. Bd. of Health, writes that the contract for collection of garbage, offal and dead animals for a period of 10 yrs. (bids opened Oct. 10) has been awarded to H. E. Rielly and J. T. King, of Bridgeport, at $2.32 per ton.

Jackson, Miss.—The construction of garbage crematory is being discussed by the Bd. of Aldermen, and a committee with T. McCleland, as Chairman, has been appointed to select site. Y. D. Lott, City Clk.

Brooklyn, N. Y.—Bids will be received until Oct. 20 (readvertisement) by John McG. Woodbury, Comr. Street Cleaning, N. Y. City, for furnishing material and removing snow and ice by April 15, 1906 in Boro. Brooklyn.

NEW INDUSTRIAL PLANTS.

See also Business Buildings.

The Monroe (N. C.) Cotton Mills are preparing to build a single-story, 80 x 250-ft. addition to their mill, to accommodate extra looms. About 200 h.p. will be added to power plant.

****Items marked thus give the names of parties awarded contracts.***

Warner Arc Lamp Co., Muncie, Ind., has purchased a factory plant and is remodeling same for its own use. The new plant consists of main building, 50 x 130 ft., part of which is 2 stories high, together with two smaller buildings and considerable ground. New machine tools will be installed in the near future.

The Ohio Cultivator Co., Bellevue, O., is building a new foundry, 76 x 250 ft., and is also adding to its engine room. Two 60-h.p. gas engines with direct-connected generators will be installed for lighting and power purposes.

Kahlenberg Bros., Two Rivers, Wis., are building an addition to their present plant, consisting of machine shop, 150x50 ft., and power house, 50x40 ft. A 60-hp. boiler will be required.

R. L. McDonald & Co., St. Joseph, Mo., are contemplating establishing a branch factory near that place, and will require a number of new sewing machines.

Banta Furniture Co., Goshen, Ind., has erected a new warehouse. This company contemplates increasing its power equipment in the spring.

Hendrick Mfg. Co., mfrs. of perforated metals, Carbondale, Pa., is increasing the capacity of its perforating plant by the addition of a 1-story brick building covering an area of 40 x 94 ft. 6 in.

Fingerville (S. C.) Mfg. Co. is planning the erection of a new cotton oil mill.

Pittsburg & Lake Erie R. R. is contemplating the erection of repair and machine shops at Glassport, Pa.

Anchor Silver Plate Co., St. Paul, Minn., contemplates rebuilding its recently burned plant. New power equipment will be required.

Menasha Paper Co., Ladysmith, Wis., is preparing plans for a new ground wood pulp mill. The new building will be 2 stories in height, will measure 38 x 160 ft., and will be constructed of concrete blocks.

Potsdam (N. Y.) Paper Mills are having plans prepared for a wall paper mill having a capacity of about 18,000,000 rolls per year. The main building will measure 275 x 75 ft.

Platt Iron Works, Dayton, O., will erect extensive additions to its plant, according to local newspaper reports.

The Doris Motor Car Co. will establish a new plant in St. Louis, Mo., according to local reports.

Henry Disston & Sons, Ltd., a branch of the firm of Henry Disston & Sons, Inc., Philadelphia, Pa., have begun the erection of a 2-story factory at Toronto, Ont., according to local newspaper reports.

The Fayetteville (Tenn.) Mill Co. is contemplating the erection of a flour mill having a capacity of 150 bbls. per day. The main building will measure 80 x 120 ft. This company is in the market for a 90-h.p. engine with boiler.

Merchants' Refrigerating Co., Kansas City, Mo., is contemplating the erection of a power plant of 400 to 450 tons refrigerating capacity. Large extensions will also be made to the street pipe line system and cold storage space of this company.

Bantleton Bros., Rochester, N. Y., have prepared plans for a $30,000 sash and blind factory, according to local newspaper reports.

Stoaker Bros., Chattanooga, Tenn., have purchased site for a large handle factory and will begin work on buildings at once, according to local newspaper reports.

Frank C. Patten Co., Shelbyville, Ill., will erect a new factory, according to local newspaper reports.

Moses Bros., Great Bend, Kan., are preparing plans for increasing the output of their flour mill, and will install an oil burning equipment in their power plant, according to local reports.

The Thomas Phillips Paper Co., Akron, O., will erect a 30 x 70 ft. brick addition to its present plant, according to local reports.

The Boss Mfg. Co., Findlay, O., has decided to build a $12,000 addition to its present glove factory, according to local newspaper reports.

R. M. Cromwell Co., Syracuse, N. Y., is preparing to erect a plant for the manufacture of gasoline engines, according to local newspaper reports.

The Lilly Bakery & Ice Cream Co., Memphis, Tenn., it is reported, will expend about $30,000 in establishing a large ice cream factory. Half of this amount will be used to purchase refrigerating and other machinery, according to local newspaper reports.

Werheim Mfg. Co., Nassau, N. Y., lumber mfrs., will rebuild on an increased scale its plant which was recently burned, according to local newspaper reports.

The Howe Scale Co., Rutland, Vt., is reported by local newspapers to be preparing plans for a large addition to its present plant.

The Red C Oil Co., Baltimore, Md., will begin at once the rebuilding of its oil refinery which was recently destroyed by fire, according to local newspaper reports.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Oakland, Cal.—The Park and Boule. Com. of City Council is reported to have recommended the passage of an ordinance appropriating $50,000 for dredging Lake Merritt.

Los Angeles, Cal.—The following are the bids opened on Sept. 30 by J. B. Lippincott, Superv. Engr., U. S. Reclamation Service, 1108 Braly Bldg., Los Angeles, for furnishing from 30,000 to 40,000 bbls. Portland cement (price given per bbl.): Pacific Portland Cement Co., Rialto Bldg., San Francisco, f. o. b. Tolenso, Cal., $1.55; Western Fuel Co., 318 California St., San Francisco, f. o. b. Napa Junc., Cal., $1.60; Western States Portland Cement Co., Independence, Kan., f. o. b. Independence, Kansas, $1.25; California Portland Cement Co., 401 Trust Bldg., Los Angeles, f. o. b. Colton, Cal., $2.45.

Colorado Springs, Colo.—D. W. Brunton, 808 17th St., Denver, writes that it is proposed to construct a drainage tunnel at Cripple Creek, to cost about $500,000.

Waterbury, Conn.—It is stated that bids will be received, until Oct. 17, by the Bd. Pub. Wks. for constructing a masonry channel, 5 ft. by 5 ft. centre height and 156 ft. long for Little Brook. R. A. Cairns, City Engr.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Baltimore, Md.—Bids will be received until Oct. 18 by Lieut. Col. R. L. Hoxie, Corps Engrs., U. S. A., for furnishing about 700 cu. yds. rip-rap stone and placing it in position at Lower Cedar Rapids Point Light Station, Potomac River, Md.

Boston, Mass.—The only bid received on Sept. 28 by the Bd. of Harbor and Land Comrs., at Boston, for the construction of 2 stone jetties, is stated to have been submitted by J. J. Callahan, of Atlantic, Mass., who offered to do the work at $1.08 per ton. About 4,800 tons will be required.

The following are the bids opened on Oct. 9 for building a wharf and coal pocket at the North Ferry, East Boston (bidders all of Boston): Lawler Bros., $25,000; Geo. H. Cavanagh, $23,975; W. H. Ellis, $23,436; J. J. Flynn, $23,242; W. L. Miller, $22,400; Cahill Constr. Co., $22,087, and Geo. W. Hayes, 166 Devonshire St., $21,224.

Savannah, Ga.—It is stated that bids will be received until Oct. 23 by the Bd. Co. Comrs. (G. Reuben Butler, Clk.) for erecting a lock at the outlet of Casey Canal.

Pomona, Ill.—Geo. Kennedy, Jr., of Murphysboro, has prepared profile and specifications for about 5 miles of dredge ditch, for Cave Valley Land & Cattle Co., of Peoria, on its ranch at Pomona.

Raymond, Ill.—It is stated that bids will be received until Nov. 4 by the Comrs. of Union Drainage Dist. No. 1 (W. A. Beatty, Chmn.) for furnishing the following salt-glazed vitrified drain tile: 6,300 ft. 20-in., 3,630 ft. 15-in., 4,620 ft. 14-in., and 4,500 ft. 12-in. It is stated that bids are also wanted for laying the above tile. Jas. W. Dappert, Engr., Taylorville, Ill.

Indianapolis, Ind.—The Bd. of Pub. Wks. is reported to have authorized the City Engr. to prepare plans and specifications for a levee along White River on Awasso St.

**Algona, Ia.*—Hunt & Warrick, of Bancroft, are stated to have secured the contract for constructing drain No. 3 in Kossuth County, for $86,339.

Rockwell City, Ia.—It is stated that bids will be received until Oct. 20 by B. E. Stonebraker, Co. Aud., for constructing a ditch and tile drain in Dist. No. 22, involving 9,100 ft. open ditch, 1,500 ft. 20-in., 1,500 ft. 18-in., 1,400 ft. 16-in., and 1,704 ft. 14-in. tile. It is stated that bids will also be received at the same time for work in Dist. 14, involving 12,944 ft. open ditch, 5,500 ft. 20-in., 3,400 ft. 18-in., 3,000 ft. 16-in., and 2,952 ft. 14-in. tile.

Clarinda, Ia.—It is stated that bids will be received until Oct. 23 by W. S. Jordan, Co. Aud., for constructing a drain in Colfax Township, requiring about 5,250 cu. yds. excav.

Independence, Kan.—Press reports state that the properties of the Cudahy Oil Co. and the Cherokee Oil Co., have been consolidated as the Cudahy Pipe Line & Refining Co., with a capital of $6,000,000. The pipe line to St. Louis will be 665 miles in length; the main pumping station will be located at Alluwe, where storage tanks will be erected. From Alluwe to Bartlesville, a 6-in. line will be constructed. From the Cudahy wells for 200 miles east to St. Louis the trunk line will be constructed of 6-in. pipe, and the balance of the distance, or 140 miles, of 8-in. pipe. Pumping stations will be built probably every 75 or 80 miles along the route, with storage tanks at each station. A site for the refinery has been secured at St. Louis, where a plant with a capacity of 6,000 bbls. will be erected.

Baton Rouge, La.—The Choctaw Basin Drainage Dist. No. 2 is reported to have decided to procure bids for the sale of $40,000 bonds, the proceeds to be used for the construction of a drainage system in the district.

**New Orleans, La.*—Contracts for levee work (bids opened Oct. 3 by the Bd. of State Engrs.) are stated to have been awarded as follows: Shreves levee, 35,000 cu. yds. to Michael Hunt at 11.3 cts. per cu. yd.; China Grove-Christiana Levee, 35,000 cu. yds., to Connell, Moss & Co., 14.11 cts.; Cummings Point levee, 32,000 cu. yds., to W. M. Rushing, at 21.4 cts. per cu. yd. and Gypsy Point Levee, 147,000 cu. yds. to Menzies & Co., 13.95 cts. per cu. yd.

Port Huron, Mich.—Bids will be received at the office of the City Controller until Nov. 3 for furnishing material and constructing the uncompleted portion of canal, from Lake Huron to Black River, as advertised in The Engineering Record.

Crookston, Minn.—It is stated that bids will be received until Oct. 20 by N. A. Hoffard, Co. Aud., for constructing ditch No. 55, 42,300 yds. excav.; bids will also be received at the same time, it is stated, for constructing ditch No. 57, 59,000 yds.

Slayton, Minn.—It is stated that bids will be received until Oct. 19 by Ole O. Holman, Co. Aud., for constructing 4 ditches involving 79,250 cu. yds. excav., total estimated cost $10,244.

Billings, Mont.—The following are the bids opened on Sept. 26 at the office of the Engineer, U. S. Reclamation Service, Billings, for furnishing about 25,000 bbls. Portland cement f. o. b. cars at works of bidder: Illinois Steel Co., Rookery Bldg., Chicago, Ill., $1.30 per bbl. f. o. b. at South Chicago, Ill.; The Portland Cement Co., Denver, Colo., $1.35 per bbl. f. o. b. at Portland, Colo. (proposal informal and not accompanied by specifications); Alpena Portland Cement Co., 410 Pioneer Press Bldg., St. Paul, Minn., $1.40 per bbl. f. o. b. Duluth, Minn., N. P. Co.'s dock (proposal requires bags returned to Duluth freight prepaid).

Jersey City, N. J.—Bids will be received until Oct. 17 by the Bd. Street and Water Comrs. (Geo. T. Bouton, Clk.) for furnishing and delivering 200 bbls. Amer. Portland cement, 15 bbls. Rosendale cement, 10 bbls. Westchester lime, 55,000 North River hard burned brick, 2,000 ft. 6, 8, 12 and 18 in. vitr. pipe, and furnishing 800 cu. yds. sand.

New York, N. Y.—Only one bid was received and opened on Oct. 3 by Col. W. N. Livermore, Corps Engrs., U. S. A., for dredging at two different points in New Jersey, and that was submitted by John & Jos. McSpirit, 118 Wayne St., Jersey City, N. J., as follows: Elizabeth River, 44 cts. per cu. yd. scow meas.; and Mattawan Creek, N. J., 28 cts. The R. G. Packard Co., 130 Pearl St., N. Y. City, submitted the only bid on the same date for dredging Keyport Harbor, N. J., 33 cts. per cu. yd. The only bid received on Sept. 29 for dredging Woodbridge Creek, N. J., was submitted by J. M. Briggs, 17 Battery Pl., N. Y. City, at 48 cts. per cu. yd.

The following are the bids opened on Oct. 3 by Col. W. R. Livermore, for dredging Raritan Bay, N. J. (price given per cu. yd. scow meas.): P. Sanford Ross, Inc., 277 Washington St., Jersey City, N. J., 15.85 cts.; R, G. Packard Co., 130 Pearl St., N. Y. City, 21.5 cts.; The W. H. Beard Dredging Co., 8-10 Bridge St., N. Y. City, 19 cts.; Morris & Cummings Dredging Co., 21 State St., N. Y. City, 21.9 cts.; Seely-Taylor Co., 78 Broad St., N. Y. City, 26 cts.; The International Contr. Co., 10 Battery Pl., N. Y. City, 18 cts., and Coastwise Dredging Co., Norfolk, Va., 16.7 cts.

Bids will be received until Oct. 24 by Wm. McAdoo, Police Comr., for furnishing and erecting all the material necessary in making and completing filling, concreting, fence wall, fence, etc., in new station house, prison and stable for the 41st Precinct, Boro. Bronx. Arthur A. Stoughton, archt., 96 5th ave.

Bids will be received until Oct. 20 by Maurice Featherson, Comr. Docks., for furnishing material and building a new pier with lateral extensions or bulkhead platform, near the foot of W. 13th St., to be known as Pier 54; also one near the foot of W. 14th St., to be known as Pier 56; bids will also be received same date for furnishing and delivering about 6,000 cu. yds. sand, all in Boro. Manhattan.

Holland, Mich.—The following are the bids opened on Oct. 4 by Col. M. B. Adams, Corps Engrs., U. S. A., Grand Rapids, for extension of piers, improving harbor at Holland, Black Lake, Mich.: (*a*) Macdonald & Beauvais, Muskegon; (*b*) Bennett-Schnorbach Co., Muskegon; (*c*) Robt. Love, Muskegon; (*d*) Great Lakes Dredge & Dock Co., Chicago, Ill.; (*e*) Burk, Smith & Nelson, Muskegon:

	a	*b*	*c*	*d*	*e*
3,200 cu. yds. dredging for crib foundation	$0.25	$0.50	$0.75	$0.30	$0.60
17,888 lin. ft. foundation piles	.50	.55	.55	.30	.60
1,104 lin. ft. oak guard piles	.40	.35	.31	.45	.40
20,649 lin. ft. piles for pile structures	.50	.30	.31	.30	.34
18.34 M. ft. oak timber	50.00	52.00	45.00	50.00	50.00
778.704 M. ft. fir timber	32.50	33.00	33.00	37.50	36.00
1,864.6 M. ft. hemlock timber	23.50	23.15	22.75	30.00	25.00
90.63 M. ft. fir planks	31.00	30.00	29.75	32.00	36.00
309,863 lbs. drift bolts	.03	.03	.0325	.035	.04
47,346 lbs. screw bolts	.03	.0325	.0325	.035	.04
7,076 lbs. tie rods	.03	.0325	.0325	.035	.04
6,169 lbs. spikes	.03	.0325	.0325	.035	.04
6,590 cords stone	6.00	6.70	7.20	6.80	7.00
Totals	$144,016	$145,973	$150,108	$159,752	$159,891

St. Louis, Mo.—All bids opened on Sept. 8 by Maj. Thos. L. Casey, Corps Engrs., U. S. A., St. Louis, for dredging pumps, pillow blocks, etc., have been rejected, as the prices were considered as excessive. The following are the bids received: (*a*) Schoellhorn-Albrecht Mchy. Co., St. Louis, Mo.; (*b*) Wm. C. Johnson & Sons Mchy. Co., St. Louis, Mo.; (*c*) Buffalo Steam Pump Co., Buffalo, N. Y.; (*d*) Rosedale Fdy. & Mchy. Co., Allegheny, Pa.; (*e*) The Springfield Boiler & Mfg. Co., Springfield, Ill.; (*f*) Jos. Edwards & Co., New York, N. Y.; (*g*) Camden Iron Wks., Camden, N. J.; (*h*) Elias Gunnell, Manitowoc, Wis.; (*i*) The Ellicott Mchy. Co., Baltimore, Md.; (*j*) J. Edw. Ogden Co., New York, N. Y.:

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*
2 centrifugal dredging pumps, price ea	$6,250.00	$4,142.25	$5.870.00	$4,050.00	$5,300.00	$5,490.00	$4,560.00	$6,475.00	$4,325.00	$5,860.00
4 pillow blocks, price ea	0.08‡	73.59	212.00	130.00	1,293.50†	268.75	124.00	208.25	200.00	300.00
4 girders or tie beams, price ea	0.08‡	308.00	368.00	145.00	.....	217.50	173.00	408.75	100.00	225.00
24 sections discharge pipe and flanges, price ea	.....	249.74	196.00	241.66⅔	300.00	201.00	155.00	260.00	.....	199.00
14 ball and socket joints (flexible joints), price ea	.....	561.84	537.50	455.00	700.00	630.00	255.00	560.71	.....	677.00

† Total for pillow blocks, including girders or tie beams.

‡ Price given per lb.

Items marked thus give the names of parties awarded contracts.

New York, N. Y.—See "Public Buildings."

Syracuse, N. Y.—See "Sewerage and Sewage Disposal."

**Cleveland, O.*—Local press reports state that the Bd. of Pub. Service has approved the contract with Williams Bros. & Morse, Builders' Exchange, for dredging the upper river, at 16¾ cts. per cu. yd.; total cost $125,000.

Panama.—The Lidgerwood Mfg. Co., of New York, N. Y., bid for furnishing to the Isthmian Canal Comn. at Washington, D. C., (bids opened Oct. 4) 6 unloaders (60 tons) $7,940 each. It did not bid for steam shovels on that date, as previously reported.

Philadelphia, Pa.—Bids will be received until Oct. 24 at the Bureau Supplies and Accounts, Navy Dept., Washington, D. C., to furnish a quantity of elevating and rammer electrical equipment at the works of the Wm. Cramp & Sons' Ship & Engine Bldg. Co., Philadelphia, for the U. S. S. Idaho and Mississippi. H. T. B. Harris, Paymaster Gen., U. S. N.

Mayor Weaver has sent to City Council with his approval the bill authorizing a temporary loan of $375,000 for deepening Delaware River channel.

Doyle & Doak, 1509 Sansom St., are reported to have secured the contract for a brick, stone and iron fence to surround the grounds of the Elkins Home for Masonic Orphans at Broad and Cayuga Sts.; cost about $22,000. Architect, Horace Trumbauer, Land Title Bldg.

Bradford, Pa.—This city expects shortly to let contracts for the building of about $5,000 worth of concrete or masonry walls.

Reading, Pa.—The following are reported to be the bids opened on Oct. 5 by the Bd. of Pub. Wks. for constructing a subway under the P. & R. Ry. tracks on Spring St.: Fehr & O'Rourke, $179,164; Nolan Bros., $166,800; Hawman Constr. Co., $157,276; H. E. Ahrens & Bros., $219,130, and Hawman Bros., $189,000; Nelson Buchanan & Co., Chambersburg (2 bids) $199,315 for the work complete, and $48,000 for the construction of a section of the work, composed of 810 ft.

**Newport, R. I.*—The War Dept. at Washington, D. C., is reported to have awarded to John F. Donovan, of New York, N. Y., the contract for the improvement of Point Judith Harbor of Refuge. The work proposed is the extension to shore arm of breakwater; cost of work about $184,500. Bids opened for this work on Aug. 30 by Lieut. Col. J. H. Willard, Corps Engrs., U. S. A., at Newport.

Chattanooga, Tenn.—Bids will be received by Maj. H. C. Newcomer, Corps Engrs., U. S. A., until Nov. 20, for constructing concrete river wall at Colbert Shoals, Tennessee River, Ala., as advertised in The Engineering Record.

Newport News, Va.—Bids will be received by Capt. E. Eveleth Winslow, Corps Engrs., U. S. A., Norfolk, until Nov. 2, for removing wreck of bark "J. D. Bischoff" off Newport News, as advertised in The Engineering Record.

Ft. Laramie, Wyo.—Bids will be received at the office of the Engineer, U. S. Reclamation Service, Denver, Colo., until Nov. 1, for furnishing 10,000 bbls. more or less of Portland cement f. o. b. cars at stations on the Chicago, Burlington & Quincy R. R. (Guernsey Branch) between Torrington and Whalen, Wyo., as advertised in The Engineering Record.

Guantanamo, Cuba.—See "Sewerage and Sewage Disposal."

Auckland, New Zealand.—Bids will be received by the Auckland Harbour Board (J. M. Brigham, Secy.) until Jan. 9 for the construction in reinforced concrete, of part of Queen St. wharf and new Ferry Jetty, as advertised in The Engineering Record. Plans and specifications can be seen at the office of the Dept. Docks and Ferries, Battery Point, New York, N. Y.

Ottawa, Ont.—Press reports state that new plans and specifications are being prepared by the Public Works Dept. (Chas. Hyman, Minister) for the improvements to the St. Andrews Rapids on Red River.

Port Burwell, Ont.—Bids will be received until Nov. 3 by the Dept. Pub. Wks. (Fred Gelinas, Secy.) Ottawa, for constructing a breakwater at Port Burwell.

PROPOSALS OPEN

For Proposals see pages 56, 60 and 63.

WATER WORKS.

Bids Close.		See Eng. Record.
Oct. 16.	Pumps, etc., Floresville, Tex	Oct. 14
Oct. 17.	**Embankment, Roswell, N. M** Adv. Aug. 26 to Sep. 30.	Aug. 26
Oct. 17.	Laying mains, Waterbury, Conn	Oct. 14
Oct. 18.	**Water Wks., Milledgeville, Ga** Adv. Sep. 9 to Sep. 30.	Sep. 9
Oct. 18.	**Mains, Boulder, Colo.** Adv. Sep. 16 to Oct. 7.	Sep. 16
Oct. 18.	Tank, etc., Perrysburg, O.	Oct. 7
Oct. 18.	Pipe, etc., Madrid, Ia	Oct. 14
Oct. 18.	Mains, New York, N. Y	Oct. 14
Oct. 18.	Smokestack, Alliance, O.	Oct. 14
Oct. 18.	Water system, Arlington Heights, Ill.	Oct. 14
Oct. 19.	**Wells, Ft. Ethan Allen, Vt** Adv. Sep. 30 to Oct. 14.	Sep. 30
Oct. 20.	System. Minooka, Ill.	Oct. 7
Oct. 21.	**Well, New Orleans, La**	Sep. 30
Oct. 21.	Main, Seattle, Wash.	Oct. 14
Oct. 23.	Distributing system, Orange, N. J	Oct. 14
Oct. 23.	Mains, Avon by the Sea, N. J	Oct. 14
Oct. 24.	**System, Ciudad Juarez, Mex**	Sep. 16
Oct. 24.	Main, Minneapolis, Minn	Oct. 14
Oct. 25.	Pumps, New York, N. Y	Oct. 14
Oct. 26.	Dams, canals, etc., Belle Fourche, S. D. Adv. Sep. 2 to Oct. 14.	Sep. 2
Oct. 28.	Canals, etc., Hood River, Ore	Oct. 7
Oct. 30.	Water wks., Bassett, Neb	Oct. 14
Oct. 31.	Well, Pensacola, Fla.	Oct. 14
Nov. 1.	Water wks., Waverly, Minn	Sep. 23
Nov. 6.	Conduit, Toledo, O.	Oct. 14
Nov. 8.	Irrig. canal, Mitchell, Neb Adv. Oct. 14.	Oct. 14
Nov. 8.	Canal work, North Platte, Neb Adv. Oct. 14.	Oct. 14
Nov. 10.	C. I. pipe, Cincinnati, O	Oct. 14
Nov. 15.	Canals, etc., Buford, N. D Adv. Sep. 30 to Oct. 14.	Sep. 30
Dec. 1.	Water works, Burlington, Wash	Oct. 14
Dec. 5.	Dam, Glendive, Mont. Adv. Sep. 16 to Oct. 14.	Sep. 16
Jan. 1.	Irrig. work, El Campo, Tex	Oct. 7
Jan. 2.	Water wks., Manila, P. I	Sep. 30
—	Tunnel, c. i. pipe, etc., Harrisburg, Pa. Adv. Oct. 7.	Oct. 7
—	Filter, etc., Yuma, Ariz	Oct. 14

SEWERAGE AND SEWAGE DISPOSAL.

Oct. 16.	Cape May, N. J. Adv. Sep. 30 to Oct. 7.	Sep. 30
Oct. 16.	Perth Amboy, N. J.	Oct. 14
Oct. 17.	New York, N. Y	Oct. 7
Oct. 17.	Troy, N. Y.	Oct. 14
Oct. 17.	Jersey City, N. J.	Oct. 14
Oct. 18.	Chicago, Ill	Oct. 14
Oct. 18.	Brooklyn, N. Y.	Oct. 14
Oct. 18.	Canton, O.	Oct. 14
Oct. 18.	E. Pittsburg, Pa.	Oct. 14
Oct. 20.	Princeton, Ind.	Sep. 30
Oct. 20.	Lake City, Fla.	Sep. 30
Oct. 20.	Grant's Pass, Ore.	Oct. 14
Oct. 20.	Indianapolis, Ind.	Oct. 14
Oct. 21.	Ft. Miley, Cal.	Oct. 7
Oct. 23.	Wauseon, O.	Oct. 7
Oct. 23.	Belding, Mich. Adv. Oct. 7 to 14.	Oct. 7
Oct. 23.	Groton, S. D.	Oct. 14
Oct. 23.	Avon-by-the-Sea, N. J.	Oct. 14
Oct. 24.	Cleveland Heights, O.	Sep. 30
Oct. 24.	Minneapolis, Minn.	Oct. 14
Oct. 25.	Clinton, Ia.	Oct. 14
Oct. 26.	Portsmouth, O. Adv. Sep. 30 to Oct. 14.	Sep. 30
Oct. 27.	Keshena, Wis.	Sep. 30
Oct. 27.	North Platte, Neb.	Oct. 14
Nov. 2.	Columbus, O. Adv. Oct. 7 to 14.	Oct. 7
Nov. 4.	Grosse Pointe, Mich.	Oct. 14
Nov. 6.	North Yakima, Wash.	Oct. 7
Nov. 6.	Glendale, O.	Oct. 14
Nov. 6.	Napoleon, O.	Oct. 14
Nov. 6.	Plainfield, N. J.	Oct. 14
Nov. 7.	Guantanamo, Cuba	Oct. 14
Nov. 7.	Chattanooga, Tenn. Adv. Oct. 14.	Oct. 14
Nov. —.	Rockport, Ind.	Oct. 7
Dec. 11.	Sheldon, Ia.	Oct. 14
Jan. 12.	Manila, P. I.	Sep. 30
—	Kirkwood, Mo. Adv. Sep. 30.	Sep. 30
—	Haddonfield, N. J.	Oct. 14

BRIDGES.

Oct. 17.	Wabasha, Minn.	Oct. 14
Oct. 17.	Two Harbors, Minn.	Oct. 14
Oct. 18.	Chicago, Ill.	Oct. 14
Oct. 19.	Spokane, Wash.	Oct. 7
Oct. 19.	Newport Ind.	Oct. 7
Oct. 19.	Trenton, N. J.	Oct. 14
Oct. 21.	Miamisburg, O.	Oct. 7
Oct. 23.	Wichita, Kan.	Oct. 14
Oct. 24.	Marion, O.	Oct. 7
Oct. 28.	Akron, O.	Oct. 14
Oct. 30.	Camden, N. J.	Sep. 23
Oct. 30.	Refton, Pa.	Oct. 7
Oct. 30.	Aberdeen, Wash.	Oct. 14
Nov. 1.	Portage, Wis.	Sep. 30
Nov. 6.	San Bernardino, Cal.	Oct. 14
Nov. 6.	Memphis, Tenn. Adv. Oct. 14.	Oct. 14
Nov. 6.	Huntsville, Ala.	Oct. 14
Nov. 8.	South Bend, Ind.	Oct. 14
Jan. 1.	Pensacola, Fla.	Sep. 30

PAVING AND ROADMAKING.

Oct. 17.	Rensselaer, N. Y.	Oct. 7
Oct. 17.	New York, N. Y.	Oct. 7
Oct. 17.	Ashland, Ore.	Oct. 7
Oct. 17.	Toronto, Ont.	Oct. 14
Oct. 17.	Trenton, N. J.	Oct. 14
Oct. 18.	Moundsville, W. Va.	Sep. 23
Oct. 18.	Cincinnati, O.	Sep. 30
Oct. 18.	Doylestown, Pa.	Sep. 30
Oct. 18.	Franklin, Pa.	Sep. 30
Oct. 18.	Westchester, Pa.	Oct. 7
Oct. 18.	Nashville, Tenn.	Oct. 7
Oct. 18.	Harrisburg, Pa.	Oct. 7
Oct. 18.	East Pittsburg, Pa	Oct. 14
Oct. 19.	Buffalo, N. Y.	Oct. 14
Oct. 19.	New York, N. Y.	Oct. 14
Oct. 19.	Jersey City, N. J.	Oct. 14
Oct. 19.	Trenton, O.	Oct. 14
Oct. 19.	Freeport, Ill. Adv. Oct. 14.	Oct. 14
Oct. 20.	Green Bay, Wis.	Oct. 7
Oct. 20.	Indianapolis, Ind.	Oct. 14
Oct. 21.	Concord, N. H.	Oct. 14
Oct. 23.	Cincinnati, O.	Sep. 30
Oct. 23.	Sherman, Tex. Adv. Oct. 7.	Oct. 7
Oct. 23.	Beloit, Wis.	Oct. 7
Oct. 23.	Bowling Green, O.	Oct. 14
Oct. 23.	Savannah, Ga.	Oct. 14
Oct. 24.	Columbus, O.	Sep. 30
Oct. 24.	Cincinnati, O.	Oct. 7
Oct. 25.	Hoboken, N. J.	Oct. 14
Oct. 25.	Brooklyn, N. Y.	Oct. 14
Oct. 25.	Altoona, Pa. Adv. Oct. 14.	Oct. 14
Oct. 28.	Spokane, Wash.	Oct. 14
Nov. 1.	Steelton, Pa. Adv. Sept. 2 to Oct. 7.	Sep. 16
Nov. 1.	Cincinnati, O.	Oct. 14
Nov. 6.	Crownpoint, Ind.	Oct. 14
Nov. 10.	Cincinnati, O.	Oct. 14

POWER, GAS AND ELECTRICITY.

Oct. 17.	Washington, D. C.	Sep. 30
Oct. 17.	Washington, D. C.	Oct. 7
Oct. 20.	Grand Rapids, Mich. Adv. Oct. 14.	Oct. 14
Oct. 20.	New York, N. Y.	Oct. 14
Oct. 23.	Chicago, Ill.	Sep. 30
Oct. 23.	New York, N. Y	Oct. 14
Oct. 24.	Columbus, O.	Sep. 30
Oct. 24.	Washington, D. C.	Oct. 14
Oct. 31.	Washington, D. C	Sep. 30
Nov. 1.	Chicago, Ill.	Sep. 9
Nov. 1.	Roosevelt, Ariz.	Sep. 16
Nov. 2.	Roosevelt, Ariz.	Sep. 23
Nov. 6.	Ft. Des Moines, Ia Adv. Oct. 14.	Oct. 14
Nov. 8.	Washington, D. C. Adv. Sep. 30 to Oct. 14.	Sep. 30
Nov. 18.	Tacoma, Wash.	Sep. 30
Dec. 2.	San Juan, Porto Rico	Aug. 19

BUILDINGS.

Oct. 16.	Schools, New York, N. Y	Oct. 7
Oct. 17.	Pub. bldgs., Chicago, Ill	Oct. 14
Oct. 17.	Pub. Bldg., New York, N. Y	Oct. 14
Oct. 18.	Post Bldgs., Vancouver Barracks, Wash. Adv. Sep. 16 to Sep. 30.	Sept. 16
Oct. 18.	Post bldg., Ft. Sam Houston, Tex Adv. Sep. 23 to Oct. 14.	Sep. 23
Oct. 18.	Hospital, Ft. Wood, N. Y. Harbor, N. Y.	Oct. 7
Oct. 18.	Pub. bldgs., Harrisburg, Pa.	Oct. 7
Oct. 18.	Plumbing post bldg., Ft. Williams, Me.	Oct. 14
Oct. 19.	School, Tomah, Wis.	Sep. 30
Oct. 19.	Post bldg., Ft. McIntosh, Tex	Sep. 30
Oct. 19.	Court house plans, Peru, Ind	Oct. 14
Oct. 20.	School, San Pedro, Cal.	Sep. 23
Oct. 20.	Bus. bldgs., Denver, Col	Oct. 14
Oct. 20.	Plumbing, etc., prison, Newark, N. J.	Oct. 14
Oct. 21.	Co. bldg., Staunton, Va	Sep. 30
Oct. 23.	Jail, Jacksonville, Fla	Oct. 14
Oct. 23.	Vent. and htg. school, Brooklyn, N. Y.,	Oct. 14
Oct. 24.	Plumbg. post bldgs., Ft. Totten, N. Y. Adv. Oct. 14.	Oct. 14
Oct. 24.	Plumbing, etc., court house, New Brighton, S. I., N. Y	Oct. 14
Oct. 24.	Hall of Records, Springfield, Mass	Oct. 14
Oct. 25.	Pub. Bldgs., Washington, D. C	Sep. 16
Oct. 25.	Y. M. C. A. Bldg., New Orleans, La.,	Oct. 14
Oct. 25.	Asylum, Ft. Wayne, Ind.	Oct. 14
Oct. 25.	Plumb., etc., pub. bldg., South Bend, Ind.	Oct. 14
Oct. 26.	Roof work on school, Washington Barracks, D. C. Adv. Sep. 30 to Oct. 14.	Sep. 30
Oct. 26.	School, Youngstown, O.	Oct. 7
Oct. 26.	School, Platteville, Wis.	Oct. 7
Oct. 26.	Htg. pub. bldgs., Brooklyn, N. Y	Oct. 14
Oct. 27.	School, Keshena, Wis.	Sep. 30
Oct. 27.	Post bldgs., Ft. Leavenworth, Kan	Oct. 7
Oct. 30.	School, Lancaster, O.	Oct. 7
Oct. 30.	Hospital bldgs., Overbrook, N. J	Oct. 7
Oct. 30.	Post bldgs., Ft. Wright, Wash	Oct. 14
Oct. —	City hall, Fargo, N. D	Sep. 30
Nov. 1.	Pub. bldg. plans, Salem, Mass	Sep. 16
Nov. 9.	Court house, Marion, Kan	Oct. 14
Nov. 14.	P. O. bldg., Colorado Spgs., Colo Adv. Sep. 23 to Sep. 30.	Sep. 23
Nov. 15.	School, Cleveland, O.	Sep. 16
Dec. 1.	Dwelling, Wilmington, N. C.	Sep. 16
Dec. 12.	Remodel. capitol, Bismarck, N. D	Sep. 30
Jan. 1.	Hotel, Davenport, Ia.	Sep. 30
Jan. 10.	Library plans, Toronto, Ont.	Sep. 23
—	Bldg. material, Yuma, Ariz	Oct. 14

MISCELLANEOUS.

Oct. 16.	Dikes, etc., New York, N. Y Adv. Sep. 30 to Oct. 14.	Sep. 30
Oct. 16.	Dredging, New York, N. Y Adv. Sept. 30 to Oct. 7.	Sep. 30
Oct. 17.	Locomotive crane, Boston, Mass	Sep. 23
Oct. 17.	Supplies, San Juan, P. R	Sep. 23
Oct. 17.	Cement, Guantanamo, Cuba	Sep. 30
Oct. 17.	Dredging, New York, N. Y Adv. Oct. 7 to 14.	Oct. 7
Oct. 17.	Supplies, Washington, D. C	Oct. 7
Oct. 17.	Channel, Waterbury, Conn	Oct. 14
Oct. 17.	Supplies, Jersey City, N. J	Oct. 14
Oct. 18.	Rip rap, Baltimore, Md.	Oct. 14
Oct. 19.	Ditch, Moorhead, Minn.	Oct. 7
Oct. 19.	Elevator, Lincoln, Neb.	Sep. 30
Oct. 19.	Ditch, Slayton, Minn.	Oct. 14
Oct. 20.	Piers, etc., New York, N. Y	Oct. 14
Oct. 20.	Remov. snow, Brooklyn, N. Y	Oct. 14
Oct. 20.	Ditch, Crookston, Minn	Oct. 14
Oct. 21.	Dredging, Washington, D. C. Adv. Sep. 23 to Oct. 14.	Sep. 23
Oct. 22.	Ditch, Rockwell City, Ia.	Oct. 14
Oct. 23.	Dredging Machine, Philadelphia, Pa Adv. Sep. 16 to Oct. 7.	Sep. 16
Oct. 23.	Vacuum cleaning system, P. O. Bldg., Lincoln, Neb. Adv. Oct. 7 to 14.	Oct. 7
Oct. 23.	Lock, Savannah, Ga.	Oct. 14
Oct. 23.	Drain, Clarinda, Ia.	Oct. 14
Oct. 24.	Supplies, Pensacola, Fla.	Oct. 7
Oct. 24.	Elevating equipment Philadelphia, Pa.,	Oct. 14
Oct. 24.	Supplies, Washington, D. C	Oct. 14
Oct. 24.	Wall, New York, N. Y	Oct. 14
Oct. 25.	Dock, Chicago, Ill.	Sep. 2
Oct. 25.	Wharf, Washington, D. C	Sep. 16
Oct. 27.	Rip rap, etc., New York, N. Y Adv. Sep. 30 to Oct. 14.	Sep. 30
Oct. 28.	Remov. rock, etc., Portsmouth, N. H.,	Oct. 7
Oct. 30.	Dredging, Washington, D. C Adv. Oct. 7 to 14.	Oct. 7
Oct. 31.	Dredging, San Francisco, Cal	Sep. 30
Nov. 1.	Garbage franchise, New Orleans, La.	Sep. 16
Nov. 1.	Jetty, Washington, D. C Adv. Oct. 7 to 14.	Oct. 7
Nov. 1.	Cement, Ft. Laramie, Wyo. Adv. Oct. 14.	Oct. 14
Nov. 2.	Remov. wreck, Newport News, Va Adv. Oct. 14.	Oct. 14
Nov. 3.	Ammunition hoists, Wash., D. C Adv. Oct. 7 to 14.	Oct. 7
Nov. 3.	Canal work, Port Huron, Mich Adv. Oct. 4.	Oct. 14
Nov. 3.	Breakwater, Port Burwell, Ont	Oct. 14
Nov. 4.	Drain, Raymond, Ill.	Oct. 14
Nov. 6.	Garb. disp., New York, N. Y Adv. Sep. 9 to Oct. 14.	Sep. 2
Nov. 6.	El. Ry. franchise, Woodland, Cal	Sep. 30
Nov. 7.	Supplies, Guantanamo, Cuba	Oct. 14
Nov. 9.	Wharf, etc., Havana, Cuba	Jul. 29
Nov. 20.	Concrete wall, Chattanooga, Tenn Adv. Oct. 14.	Oct. 14
Dec. 15.	R. R., Manila, P. I	Sep. 16
Jan. 1.	Statue plans, Indianapolis, Ind	Jul. 22
Jan. 9.	Wharf, etc., Auckland, N. Z Adv. Oct. 14.	Oct. 14
Apr. 2, '06.	Harbor Work, Valparaiso, Chili, Adv. Apr. 29 to Sep. 9.	Apr. 29
—	Grading, Baltimore, Md. Adv. Sep. 30 to Oct. 7.	Sep. 30

**Items marked thus give the names of parties awarded contracts.*